SPECIAL PROVISIONS

FOR

<Project Name>

At The

[AIRPORT] AIRPORT

In the City of Los Angeles, California

Date

BY WAY OF EXPLANATION

This set of standard specifications for Los Angeles World Airports (LAWA) construction projects is the first edition of its kind to standardize the specifications for LAX, and Van Nuys Airports.

This set of specifications has been devised from previous projects at LAX that were successfully completed during the years of 2002-2010 at LAX. It also includes significant updates that were a result of experiences that occurred during construction projects.

This is meant to be a document to provide guidance for future LAWA projects, but there are many decisions in the specifications that will need to be made by the Engineer-of-Record for each project. Each design team shall complete a thorough review of the specifications and make decisions as required by the specific conditions of each project, especially as indicated by the [WORDS IN BOLD BRACKETS].

TECHNICAL PROVISIONS

These specifications modify the provisions in the "Greenbook" Standard Specifications for Public Works Construction (SSPWC, 2009 edition including Supplements as amended by the City of Los Angeles Department of Public Works "Brown Book"). Subsections that appear in these specifications have been modified from the SSPWC. If a Subsection of the SSPWC is not modified in these specifications, it is considered to apply under the Contract as written in the SSPWC.

SECTION 1 - TERMS, DEFINITIONS, ABBREVIATIONS AND SYMBOLS

1-1 TERMS. *To this SSPWC subsection add the following:*

References to Sections shall refer to Sections and Subsections of this document, and to the Sections and Subsections of the SSPWC as modified by this document.

1-2 DEFINITIONS. *To this SSPWC subsection add the following (replacing like terms):*

AGENCY. City of Los Angeles, Department of Airports, also known as Los Angeles World Airports (LAWA).

AIRPORT MAINTENANCE SUPERVISOR. The Airport Maintenance Supervisor of the [Airport] or this Supervisor's authorized representative.

AIRCRAFT PARKING POSITIONS: That portion of an apron used for parking aircraft to enplane and deplane passengers, or to load, or unload cargo.

AIRCRAFT SERVICE AREA: Portion of an apron adjacent to an aircraft parking position. They are used by airline personnel and equipment for servicing aircraft and staging of baggage, freight, and mail for loading and unloading of aircraft.

AIRPORT MANAGER. The Airport Manager of the [Airport] Airport or this Manager's authorized representative, having administrative responsibility for Operations and Security at the Airport, including enforcement of all airport rules and regulations affecting the Work.

AIRPORT MAINTENANCE SUPERVISOR. The Airport Maintenance Supervisor of the [Airport] Airport or this Supervisor's authorized representative.

AIRPORT MANAGER: The Airport Manager of the [Airport] Airport or this Manager's authorized representative, having administrative responsibility for Operations and Security at the Airport, including enforcement of all airport rules and regulations affecting the Work.

AIR OPERATIONS AREA (AOA). Any area of the airport used or intended to be used for the landing, takeoff or surface maneuvering of aircraft and all of the area within the airport security fence.

ALLOWANCE. An amount established in the Bid by the Agency to reimburse the Contractor for its actual expenses for an item of Work.

APRON: That non-movement area prepared for the positioning or parking of aircraft during ground operations not involving landing and takeoff of airplanes. The areas are usually

designed according to use, such as terminal, cargo, parking, service hangar, or holding apron. Such terms as "ramp", "hardstand," turnaround," etc., are synonymous with apron.

AWARD OF CONTRACT. The date the Board approves and awards the contract.

BOARD. The Board of Airport Commissioners of the City of Los Angeles.

CITY. The City of Los Angeles or the City of Los Angeles acting through the Board of Airport Commissioners.

CLAIM. A separate written demand by the Contractor for:

1) A time extension.
2) Payment of money or damages arising from Work done by or for the Contractor pursuant to the Contract and payment of which is not otherwise expressly provided for or to which the claimant is not otherwise entitled.
3) An amount, the payment of which is disputed by the Agency.

CONSTRUCTION MANAGER. [Insert name here.]

CONTRACT COMPLETION DATE. The date the City accepts the entire Work as being in compliance with the Contract Documents, and authorizes the final payment in accordance with the requirements set forth in these Contract Documents.

CONTRACT DOCUMENTS. Including but not limited to (listed in no particular order):

1) Formal Construction Contract executed by the Executive Director.
2) Notice Inviting Bids.
3) Instructions to Bidders.
4) Contract Addenda (which pertain to the Contract Documents).
5) Bid (including documentation accompanying the Bid and any post-bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Contract.
6) Bonds.
7) Permits from other Agencies.
8) Special Provisions.
9) Plans.
10) Standard Plans.
11) SSPWC.
13) Reference Specifications
14) Reference Drawings

COORDINATION: The Contractor shall be responsible for furnishing all labor, material and equipment including all suppliers, subcontractors, specialty contractors, utility companies, any and all 3rd party entities to make a project complete, in accordance with the contract documents. Coordination includes all communication, setting up meetings,

meeting minutes, scheduling, escorting onto AOA, vehicle permits and all other requirements required by the contract documents.

DAY. Whether capitalized or not, unless otherwise specifically provided, means calendar day, including weekends and legal holidays.

DESIGN CONSULTANT/ARCHITECT. [Insert name here].

ENGINEER. The Chief Airports Engineer of LAWA or this Engineer's authorized representative.

EQUAL/OR EQUAL. The product, equipment, or material which is proposed by the Contractor for use in the Work at no additional cost which in the sole judgment of the Engineer is equal to or better than the product or material specified in the Contract Documents as to function, performance, reliability, quality, and general configuration.

EXECUTIVE DIRECTOR. The Executive Director of LAWA or duly authorized representative.

FIELD MEMO. A letter issued by the Engineer to the Contractor directing Contract Work or a change in Work.

FOREIGN OBJECT DEBRIS (FOD): Any object capable of being ingested into aircraft engines or penetrating aircraft tires. Examples are knives, forks, spoons, hand tools, bolts, nails, nuts, cable, polyurethane, vehicle parts, sand, gravel, paper, rocks, dirt, cans, glass, wood, etc.

IMAGINARY SURFACE: Surfaces defined in FAR Part 77, centered on the runways, above which no equipment or objects are allowed to penetrate.

INSPECTOR. An authorized representative of the Engineer assigned to inspect the Work of the Contractor.

JET BLAST: Jet blast is the force of jet exhaust produced by the aircraft engines. The high velocities produced by aircraft engines are capable of causing bodily injury to personnel and damage to equipment.

LIQUIDATED DAMAGES. The amount the Contractor shall pay to the Agency due to the Contractor's failure to complete the Work or submit the schedule within the time specified, or for non-compliance with other Contract requirements.

MATERIALS CONTROL INSPECTOR. An authorized representative of the Engineer assigned to inspect materials, equipment, and fabricated articles furnished by the Contractor at sources other than the project Site.

MOVEMENT AREA: The movement area consists of runways, taxiways, and other areas of the airport which are used for taxiing or hover taxiing, air taxiing, takeoff and landing of aircraft, exclusive of loading aprons and aircraft parking areas.

MUNICIPAL CODE. The Municipal Code of the City of Los Angeles, which includes the Building Code, the Electrical Code, the Mechanical Code, the Plumbing Code, and all other ordinances of the City.

NON-MOVEMENT AREA: That area of the AOA not defined as a movement area and including the exterior of buildings on or adjacent to the non-movement area.

NOTICE OF AWARD. The date on which the Board awards the contract for this Project.

NOTICE TO PROCEED. The written notice by LAWA to the Contractor stating that the Work or portions of the Work may commence.

OWNER: Los Angeles World Airports.

PARTIAL ACCEPTANCE. Any portion of the Work which has been completed in accordance with the Contract Documents and has been accepted in writing by the Engineer and the Inspector.

PROJECT. All Work and/or construction operations required by the Contract Documents.

QUALITY ASSURANCE. Those standards and procedures exercised by the Agency, Inspector and the Engineer to ensure that the Contractor constructs the Work in accordance with the Contract Documents.

QUALITY CONTROL. Those standards, systems, processes, procedures and activities exercised by the Contractor, Subcontractors and Suppliers to ensure that the Work is constructed in accordance with the Contract Documents.

RUNWAY: A clearly defined area on the airport which has been prepared and is suitable for landing and takeoff of airplanes. The principal runway elements include the structural pavement, shoulders, blast pads, runway safety area, extended runway safety area, and airport imaginary surfaces. The runway drainage system, lighting, marking and areas required for landing aids are also integral design parts of the runway.

SERVICE ROADS: Identified rights-of-way on apron designated for aircraft ground service vehicles and fire equipment.

SITE. The physical location where the Project is to be constructed, including all areas designated for staging, storage, parking, and temporary offices as shown on the plans.

SUBSTITUTION. Any product, equipment, or material which is proposed by the Contractor for use

in the Work at no additional cost to the Agency which in the sole judgment of the Engineer is equal to or better than the product or material specified in the Contract Documents as a function, performance, reliability, quality, and general configuration.

STANDARD SPECIFICATIONS / PLANS: The Standard Specifications for Public Works Construction, 2009 edition as modified by City of Los Angeles Bureau of Engineering Brown Book; referenced Standard Plans (current version) of the City of Los Angeles, Department of Public Works, Bureau of Engineering. The Standard Plans include details of standard structures, devices or instructions referred to on the Project Plans or in the Specifications by title or number. Unless otherwise indicated, the applicable Standard Plans designated in the Contract Documents are the City of Los Angeles, Bureau of Engineering, Standard Plans. Sets of Standard Plans are available for purchase from Building News Inc. (Tel: (800) 873-6397), from Builders Books (Tel: (800) 273-7375, or from the City's Public Counter, Suite 600, 600 S. Spring St., Los Angeles, CA 90014.

STREET-SIDE OF BUILDINGS: Exterior of building and roof on street side, outside of the AOA streets, multilanes, drives, parking garage, and remote parking lots. This area is also referred to as the landside of the airport.

SUBSTANTIAL COMPLETION. The point at which the Work or a portion of the Work is sufficiently complete and accepted, as determined by the Agency, in accordance with Contract Documents, to be occupied and utilized by the Agency for its intended purpose pursuant to Subsection 6-10.

SUBSTITUTION: Any product, equipment, or material which is proposed by the Contractor for use in the Work at no additional cost to the Agency which in the sole judgment of the Engineer is equal to or better than the product or material specified in the Contract Documents as a function, performance, reliability, quality, and general configuration.

SUPERVISOR: Any individual proposed by the Contractor that has active and direct superintendence of details of Work.

SURETY. The person, firm, or corporation that executes as Bonding Co. Surety the Contractor's Performance Bond and the Labor and Material Bond.

SURVEYOR. A surveyor with a current California land surveyor license or registered civil engineer authorized to practice land surveying in California.

TAXILANES: Pavement areas reserved to provide taxing aircraft with access to and from parking positions.

TAXIWAY: A defined path over which airplanes can taxi from one part of an airport to another. It includes the structural pavement, shoulder, taxiway safety area, and obstacle-free area.

UNSUITABLE WEATHER: Atmospheric or environmental conditions which restrict

construction activities and/or affect operation of aircraft while approaching a runway to land; during landing; taxiing between runways, ramps, aprons, hangars, or loading zones; standing by to takeoff; or during takeoff as determined by the Airport Operations or the Engineer or his authorized representative. In addition, if a cloud condition is below 1,000 feet above ground level and or the prevailing visibility is below 3 statue miles, as reported by the air traffic control tower at [Airport] Airport, or if environmental conditions which may, in the opinion of the Engineer, affect the final outcome, position, or condition of construction work, maintenance work, or improvement of any sort or nature.

VEHICLE SERVICE ROADS: Identified rights-of-way in the non-movement area designated for vehicular movement on the AOA. Drive lanes are delineated by white lines or traffic markings painted on the pavement.

WORK. All labor, materials, equipment, services, permits, licenses and taxes, and all other things necessary for the Contractor to perform its obligations and complete the Project.

WORKING DAY. For purposes of the working day, working hours shall begin at 7:00 a.m. and, unless otherwise approved by the Engineer, shall end at 3:00 p.m. Anything received after 3:00 p.m. will be considered to be received on the next day.

1-3 ABBREVIATIONS.

1-3.1 General. *This subsection applies as written in the SSPWC.*

1.3.2 Common Usage. *To this SSPWC subsection, add the following and include the abbreviations defined and shown on the Plans:*

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ACAMS .....Access Control and Monitoring System
ADA .....Americans with Disabilities Act
AGB .....Alley grating basin
AL Allowance
ALCMS Airfield Lighting Control and Monitoring System
ALSF.....Approach Lighting System with Sequence Flashing Lights
AOA .....Air Operations Area
ARHM .....Asphalt-rubber hot-mix
ASDE .....Airport Surface Detection Equipment
ASOS .....Automated Surface Observing System
ASR .....Airport Surveillance Radar
ATSAC .....Automated Traffic Surveillance and Control System
BAGR .....Bridge approach guard railing
BB .....Beginning of Bridge
BMP .....Best Management Practices
BPW.....Board of Public Works
BSJ .....Bell and spigot joint

BSL .....Bureau of Street Lighting
BTRC .....Business Tax Registration Certificate
C&M .....Construction and Maintenance
CAB .....Crushed Aggregate Base
CCD .....Charged Coupled Device
CGB .....Curbside grating basin
CIDH .....Cast-in-drilled-hole
CIP .....Cast-in-place
CLSM.....Controlled Low Strength Material
CQC .....Contractor Quality Control
CTB.....Cement Treated Base
DBE.....Disadvantaged Business Enterprise
DMBB .....Double metal beam barrier
EB .....End of bridge
ESA .....Environmentally Sensitive
FAR.....Federal Aviation Regulations
FTA .....Fully traffic actuated
GC .....Grade change
GCASP.....General Construction Activity Stormwater Permit
HS .....High strength
IITL.....Independent Inspection and/or Testing Laboratory
ILS .....Instrument Landing System
IPW .....Inspector of Public Works
ITD.....Information Technology Division
LAMC.....Los Angeles Municipal Code
LIR.....Low Impact Resistant
LLWAS.....Low Level Wind Sheer Alert System
LOC.....Localizer

MA .....Mast Arm
MALSR.....Medium Intensity Approach Lighting System
MB .....Metal beam
MBB .....Metal beam barrier
MBGR .....Metal beam guard railing
MBE .....Minority Business Enterprise
MCR .....Middle of curb return
MED .....Median
MM .....Multimode
MSM .....Mandatory subcontracting minimum
MTH .....Month
MTL .....Material
NFPA .....National Fire Protection Association
NOI .....Notice of Intent
NPDES.....National Pollutant Discharge Elimination Permit
NTP.....Notice to Proceed

OH .....Overhead
OSA .....Office of the State Architect
OBE .....Other Business Enterprise
PAPI .....Precision Approach Path Indicator
PCC.....Portland Cement Concrete
PE.....Polyethylene (jacket of cable)
PMB.....Processed Miscellaneous Base
QA .....Quality Assurance
QC .....Quality Control
RCP.....Reinforced Concrete Pipe
RFI .....Request for Information
RVR .....Runway Visual Range
RWY .....Runway
SCHED .....Schedule
SM.....Single Mode
SOCB.....Side opening catch basin
SRJ .....Steel ring joint (for RCP)
SSC .....Systems Service Center
SSPWC .....Standard Specification for Public Works Construction
STDP.....Standard Plans
SWMP.....Storm Water Management Plan
SWPPP.....Storm Water Pollution Prevention Plan
TCP .....Traffic control plan
TF.....Top of footing
TH .....Test hole
TIA.....Telecommunications Industry Alliance
TWY .....Taxiway
V-NET.....Video Network
VT .....Variable thickness
WATCH.....Work Area Traffic Control Handbook
WBE .....Women Business Enterprise
WDID.....Waste Discharge Identification Number
WWECP.....Wet Weather Erosion Control Plan

1-3.3 Institutions. *To this SSPWC subsection, add the following and include the abbreviations defined and shown on the Plans:*

AQMD .....Air Quality Management District
DWP.....Los Angeles Department of Water & Power
DWPPS .....Los Angeles Department of Water & Power, Power System
DWPWS .....Los Angeles Department of Water & Power, Water System
FAA.....Federal Aviation Administration
IITL.....Independent Inspection and/or Testing Laboratory
LADGS .....Los Angeles Department of General Services
LADOT .....Los Angeles Department of Transportation
LADWP .....Los Angeles Department of Water and Power

LACDPW	Los Angeles County Department of Public Works
LAWA	Los Angeles World Airports
MTA	Metropolitan Transportation Authority (of Los Angeles County)
MWD	Metropolitan Water District
NWS	National Weather Service
PACBELL	Pacific Bell (Pacific Telesis Group)
RCC	Rail Construction Corporation
SBC	SBC (telephone – formerly Pacific Bell)
SCAQMD	South Coast Air Quality Management District
SCG	Southern California Gas Company
SCE	Southern California Edison
SCRRA	Southern California Regional Rail Authority
SWRCB	State Water Resources Control Board
UBC	Uniform Building Code
USA	Underground Services Alert

1-4 UNITS OF MEASURE. *This subsection applies as written in the SSPWC.*

END OF SECTION 1

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SECTION 2 - SCOPE AND CONTROL OF THE WORK

2-1 AWARD AND EXECUTION OF CONTRACT. *This subsection applies as written in the SSPWC.*

2-2 ASSIGNMENT. *This subsection applies as written in the SSPWC.*

2-3 SUBCONTRACTS.

2-3.1 General. *Delete this SSPWC subsection and replace with the following:*

The Contractor shall comply with the Chapter of Public Contract Code including Sections 4100 through 4113. A copy of the Public Contract Code may be found at www.leginfo.ca.gov.

If the Contractor fails to specify a Subcontractor, or specifies more than one Subcontractor for the same portion of the Work to be performed under the Contract (in excess of one-half of one percent [1/2%] of the Contractor's total Bid), the Contractor shall be qualified to perform that portion itself, and shall perform that portion itself, except as otherwise provided in the Code.

Unless otherwise provided in the Contract Documents or when direct communications have been specifically authorized, communications between any Subcontractor and the Agency shall be through the Contractor.

2-3.2 Additional Responsibility. *Delete the second paragraph in this SSPWC subsection and replace with the following:*

The contractor shall perform, with its own organization, Contract Work amounting to at least twenty percent (20%) for building work, and thirty-five percent (35%) for civil work, of the Contract price. The subcontracting of any portion of the Work shall not relieve the Contractor of its responsibilities under the contract. General provisions, profit, bonds, supervision, etc., shall not be included in the percentage of Work required to be completed by the Contractor.

2-3.3 Status of Subcontractors. *This subsection applies as written in the SSPWC.*

2-3.4 Listed Subcontractors. *To the SSPWC add subsection 2-3.4 as follows:*

The Contractor shall have submitted with the Bid a list that specifies both of the following:

1) The name and address of each Subcontractor who will perform work or labor or render service to the bidder in or about the construction of the work or improvement in an amount in excess of one-half of one percent (1/2%) of the Contractor's total Bid, or $10,000, whichever is greater.
2) That portion of the Work, as defined in the Bid, which will be done by each listed Subcontractor.

On any portion of the Work shown in the Bid to be done by a listed Subcontractor, the

Contractor shall submit to the Engineer, prior to commencement of said Work, a written statement giving the Work to be subcontracted and the name, business, address, phone number, and Contractor License Number of the proposed Subcontractor together with a copy of the completed and signed Subcontractor's Equal Employment Practices or Affirmative Action forms. Consent in writing by the Engineer shall be received before said subcontracted Work is started.

2-3.4.1 Substitution.

The Contractor may not substitute any person as Subcontractor in place of the Subcontractor listed in the original Bid or offer, except in the following instances:

1) When the Subcontractor listed in the Bid after a reasonable opportunity to do so fails or refuses to execute a written contract when such written contract, based upon the general terms, conditions, other Contract Documents for the Project involved, or the terms of such Subcontractor's written bid, is presented to it by the Contractor.
2) When the listed Subcontractor becomes bankrupt or insolvent.
3) When the listed Subcontractor fails or refuses to perform its subcontract.
4) When the listed Subcontractor fails or refuses to meet the bond requirements of the Contractor as set forth in the Subcontractor's Performance Bonds Subsection of this Section.
5) When the Contractor demonstrates to the satisfaction of the Engineer that the Subcontractor was listed by inadvertent clerical error.
6) When the Engineer determines that work being performed by the listed Subcontractor is substantially unsatisfactory and not in substantial accordance with the Contract Documents, or the listed Subcontractor is substantially delaying or disrupting the progress of the Work.
7) When the listed Subcontractor fails to submit an Affirmative Action Plan acceptable to the Board.
8) When a listed Subcontractor becomes or is unlicensed.

The Contractor, as a condition of asserting a Claim of inadvertent clerical error in a listing of a Subcontractor, shall within two (2) Working Days after the time of the bid opening by the Engineer, give written notice to the Engineer and copies of such notice to both the Subcontractor it claims to have listed in error and the intended Subcontractor who had bid to the Contractor prior to the bid opening. Any listed Subcontractor who has been notified by the Contractor in accordance with this Section as to an inadvertent clerical error, shall be allowed six (6) Working Days from the time of the bid opening within which to submit to the Engineer and to the Contractor written objection to the Contractor's Claim of inadvertent clerical error.

In all cases, the Contractor must make a request in writing, to the Engineer for the Substitution of listed Subcontractors. Each written request shall include reasons for the Substitution. The Engineer shall mail a written notice to the listed Subcontractor giving reasons for the proposed substitution. The listed Subcontractor shall have five (5) Working Days from the date of such notice within which to file with the Engineer written objections to the Substitution.

Failure to file written objection pursuant to this Section within the times specified herein, shall constitute a waiver of objection to the substitution by the listed Subcontractor and, where the ground for Substitution is an inadvertent clerical error, an agreement by the listed Subcontractor that an inadvertent clerical error was made.

If written objections are filed, the Engineer shall give five (5) Days' notice to the Contractor and to the listed Subcontractor of a hearing by the Board or its duly authorized officer on the Contractor's request for Substitution. The determination by the Board or its duly authorized officer shall be final.

2-3.5 Unlisted Subcontractors. *To the SSPWC add subsection 2-3.5 as follows:*

Permission to use Subcontractors for any portion of the Work not required to be listed as indicated above shall be requested in writing to the Engineer. Such requests shall give a description of the Work to be subcontracted and the name, business, address, phone number Contractor License Number of the proposed Subcontractor together with a copy of the completed and signed Subcontractor's Equal Employment Practices or Affirmative Action forms. Consent of the Engineer in writing shall be received before the subcontracted Work is started.

When a portion of the Work which has been subcontracted by the Contractor to an unlisted Subcontractor is not being prosecuted in a satisfactory manner, this Subcontractor shall be removed immediately on the written request of the Engineer and shall not again be employed on the Work.

2-3.6 Subcontractor's Performance Bonds. *To the SSPWC add subsection 2-3.6 as follows:*

In the event any Subcontractor submitting a bid to the Contractor does not, upon request of the Contractor and at the expense of the Contractor at the established charge or premium thereof, furnish to the Contractor a bond or bonds issued by an admitted surety wherein the Contractor shall be named the obligee, guaranteeing prompt and faithful performance of such subcontract and the payment of all claims for labor and materials furnished or used in and about the Work to be performed and performed under such subcontract, the Contractor may reject such bid and make a Substitution of another Subcontractor subject to the Substitution provisions of this Section. Such bond or bonds may be required at the expense of the Subcontractor only if the Contractor in its written or published request for sub-bids:

1) Specifies that the expense for such bond or bonds shall be borne by Subcontractor.
2) Clearly specifies the amount and requirements of such bond or bonds.

2-3.7 Assignment. *To the SSPWC add subsection 2-3.7 as follows:*

The Contractor shall not permit any subcontract to be voluntarily assigned or transferred or allow it to be performed by anyone other than the original Subcontractor listed on the original Bid without the consent of the Board or its duly authorized officer.

2-3.8 Penalties. *To the SSPWC add subsection 2-3.8 as follows:*

A Contractor violating this Subsection 2-3 shall be deemed in violation of the Contract and the Agency may, at its discretion, cancel the contract and/or assess the Contractor a penalty of not more than ten percent (10%) of the amount of the subcontract involved. The Contractor is in violation of the California Business and Professions Code if the Contractor utilizes inactive license holders or unlicensed Subcontractors. Violation of this Code may result in the Board declaring the Bid to be non-responsive. The Agency will report all violations to the Contractor's State License Board.

In any proceeding under this Subsection 2-3, the Contractor shall be entitled to a public hearing and to five (5) Days' notice of the time and place thereof.

2-4 CONTRACT BONDS. *To the first paragraph of this SSPWC subsection add the following:*

The Executive Director shall act in the place of the Board in approving surety bonds.

Replace the fourth paragraph of this SSPWC subsection with the following:

The Faithful Performance Bond shall be for one hundred percent (100%) of the Contract price. The Contractor shall arrange to have the Faithful Performance Bond remain in full effect for the warranty period or one (1) year after acceptance of the Work by the Executive Director, whichever is longer. This shall be done as a guarantee that the Contractor shall satisfactorily correct any deficiencies in materials or workmanship of which the Agency notifies the Contractor within that year. The Contractor shall submit all bonds within thirty (30) Days of the Notice of Award.

2-5 PLANS AND SPECIFICATIONS.

[The Design Codes MUST be referenced on the plans]

2-5.1 General. *To the first paragraph of this SSPWC subsection add the following:*

The Contractor shall maintain at the Project Site, a copy of the Project Plans and Specifications, apart from documents used for construction. The Contractor shall maintain documents in a clean, legible condition and make documents available at all times for inspection by the Engineer and Inspector.

At the end of this SSPWC subsection add the following:

[Six (6)] copies of the Project Plans and Special Provisions will be available at no cost to the Contractor. The Contractor must obtain and pay for sufficient copies of the SSPWC, Reference Specifications, and Standard Plans to maintain supervision of the Work.

Plans and Special Provisions furnished by the Agency are its property. They are not to be used on other work. Models are the property of the Agency and shall be returned upon completion.

[PE: If B-permit is involved, include paragraph below.]

All Work on traffic signal installations shall conform to the latest edition including amendments of the LADOT "Special Provisions and Standard Plans for the installation and modification of traffic signals." All Work on parking meter posts shall conform to the Department of Transportation Specifications No. 82-012-02, "Detail of Parking Meter Posts" available at 221 N. Figueroa Street, Suite 500, Los Angeles, CA 90012.

2-5.2 Precedence of Contract Documents. *Delete this SSPWC subsection and replace with the following:*

If there is a conflict between Contract Documents, the document highest in precedence shall control. Unless otherwise specified the precedence shall be:

1) Federal and State requirements.
2) Permits from other agencies as may be required by law.
3) Addenda, Change Orders, Supplemental Agreements, and approved revisions to Plans and Specifications.
4) Formal Construction Contract executed by the Executive Director.
5) Special Provisions
6) Plans (detailed plans shall have precedence over general plans).
7) Standard Plans.
8) Standard Specifications for Public Works Construction.
9) Reference Specifications.
10) Reference Drawings.

In case of a conflict within a Contract Document, the provision with the more restrictive/highest stringent interpretation shall govern. Anything mentioned in the Special Provisions and not shown on the drawings or shown on the drawings and not mentioned in the Special Provisions shall be of like effect as if shown or mentioned in both. The Contractor may request clarification from the Engineer of the governing provision. The Contractor shall not be entitled to extra compensation or time extension due to possible conflicts between the provisions of these documents.

2-5.3 Shop Drawings and Submittals.

2-5.3.1 General. *Delete the third paragraph of this SSPWC subsection and replace with the following:*

The Contractor shall allow a minimum of thirty (30) Days for each shop drawing and submittal review, unless otherwise modified in the Contract Documents. Review periods are not cumulative. The aforementioned time frames begin anew upon each submission of shop drawing and/or submittal whether it is the initial submission or a resubmission after review by the

Engineer. Each set of shop drawings or submittals shall be accompanied by a letter of transmittal describing exactly what is being transmitted.

All Contractor submittals shall be carefully reviewed for completeness and compliance with the Contract Documents, by an authorized representative of the Contractor, prior to submission to the Engineer. Each submittal shall be dated, signed and certified by the Contractor as being correct and in strict conformance with the Contract Documents. No consideration for review by the Engineer of any Contractor submittals will be made for any items, which have not been certified by the Contractor. All non-certified submittals will be returned to the Contractor without action taken by the Engineer and any delays caused thereby shall be the total responsibility of the Contractor.

The Contractor shall be responsible for delivering reviewed copies of shop drawings and submittals to all others whose work is dependent herein. The Contractor shall maintain at the Site a complete file of approved shop drawings and submittals for this Project.

2-5.3.2 Shop Drawings and Coordination Drawings. *Delete this SSPWC subsection and replace with the following:*

Shop drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data which are prepared by the Contractor or any Subcontractor, manufacturer, supplier, or distributor and which illustrates some portion of the Work. The Contractor shall submit, for review by the Engineer, **[seven (7)]** copies of shop drawings as called for in this Section and the Contract Documents and as requested by the Engineer. All shop drawings shall be of a size and scale to show clearly all necessary details. Shop drawings shall show in detail the size, sections, and dimensions of all the member(s); the arrangement and construction of all connections and joints; all holes, straps, and other fittings required for attaching work; and other pertinent details. When required, engineering computations by a Professional Engineer licensed by the State of California, Board of Professional Engineers and Land Surveyors shall be submitted.

Shop drawings shall be accompanied by the Engineer's standard submittal transmittal form, which may be obtained from the Engineer. The transmittal form forwarding shop drawings shall list the number of drawings submitted, the name of the Project, the name of the Contractor, and, if any, the names of Suppliers, manufacturers, and Subcontractors. Shop drawings shall be submitted at a time sufficiently early to allow a thirty (30) Day review period by the Engineer and to accommodate the rate of construction progress required under the Contract. Any delays to the Project schedule due to late submission of shop drawing shall be the sole responsibility of the Contractor.

Shop drawings shall be complete in all respects. If the shop drawings show any deviations from the requirements of the Contract Documents, because of standard shop practices or other reasons, the deviations and the reasons therefore shall be clearly set forth in the letter of transmittal. By submitting shop drawings, the Contractor represents that material, equipment, and other Work shown thereon conforms to the Contract Documents, except for any deviations set forth in the

letter of transmittal. The Contractor, in the letter of transmittal accompanying resubmitted shop drawings, shall direct specific attention to revisions other than the corrections requested by the Engineer on previous submittals.

The review by the Engineer is only of general conformance with the design concept of the Project, and general compliance with the Contract Documents and shall not relieve the Contractor of the full responsibility for providing materials, equipment, and Work required by the contract; the proper fitting and construction of the Work; the accuracy and completeness of the shop drawings; selecting fabrication processes and techniques of construction; and performing the Work in a safe manner. Any fabrication or other Work performed in advance of the receipt of accepted submittals shall be entirely at the Contractor's risk and expense. Revisions indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for Claims for extra Work.

Except as otherwise noted, the Engineer will return **[two (2)]** prints of each submittal to the Contractor, with its comments noted thereon, within thirty (30) Days from the following their receipt by the Engineer.

No portion of the Work, including fabrication, requiring a shop drawing submittal shall be commenced until the submittal has been reviewed by the Engineer and returned to the Contractor with a notation indicating that resubmittal is not required. A separate transmittal form shall be used for each specified item or call of material or equipment for which a submittal is required. All Work for which shop drawings are required shall be performed in accordance with the reviewed and approved copies.

Within 10 days of the Notice of Award, the Contractor shall submit for approval a list of proposed submittals and shop drawings which he intends to submit. The Engineer will modify the list and return it to the Contractor within 5 days of receipt, adding any items that the Contractor has neglected to list, but which the Engineer feels warrants a submittal.

Without waiving any specific requirements of the Contract Documents, the following table lists items that are examples of but not limited to, items that require the submittal of shop drawings:

[Append table as appropriate to the project:]

TABLE 2-5.3.2(A)

Item	Section Number	Title	Subject
1	7-10.4.1	Safety Orders	Trench shoring
2	207-2.5	Joints	Reinforced concrete pipe
3	207-8.4	Joints	Vitrified clay pipe
4	207-10.2.1	General	Fabricated steel pipe
5	300-3.2	Cofferdams	Structure excavation and backfill

6	303-1.6.1	General	Falsework
7	303-1.7.1	General	Placing reinforcement
8	303-3.1	General	Prestressed concrete construction
9	304-1.1.1	Shop Drawings	Structural steel
10	304-1.1.2	Falsework Plans	Structural steel
11	304-2.1	General	Metal hand railings
12	306-2.1	General	Jacking operations
13	306-3.1	General	Tunneling operations
14	306-3.4	Tunnel Supports	Tunneling operations
15	306-6	Remodeling Existing Sewer Facilities	Polyethylene liner installation
16	306-8	Microtunneling	Microtunneling operations
17	307-4.3	Controller Cabinet Wiring Diagrams	Traffic signal construction
18	306-1.2.2	Pipe laying	Pipeline shop drawings
19	5-2	Protection	Utility Supports
20	7-10.3.7	Temporary Bridges	Temporary Bridge Reconstruction
21		Dewatering	

Shop drawings listed above as Items 5, 6, 8, 9, 10, 12, 13, 14, 16 and 20 shall be prepared by a Civil or Structural Engineer registered by the State of California.

The Contractor shall submit Coordination Drawings to the Engineer for review within forty-five **[(45)]** Days after the NTP. Coordination Drawings are necessary when close and careful coordination is required for installation of products and materials fabricated off-site by separate entities and/or where limited space availability necessitates maximum utilization of space for efficient installation of different components.

The Coordination Drawings submittals shall comply with the following:

1) Show the interrelationship of components shown on shop drawings.
2) Show the interrelationship of all utility and/or trade work (e.g., electrical, telecom, mechanical, piping, plumbing, fire, and life safety).
3) Indicate required installation sequences.
4) All of the submittal requirements contained in Subsection 2-5.

2-5.3.3 Submittals. *To this SSPWC subsection add the following:*

Coordinate preparation and processing of submittals with performance of construction activities.

Submittals shall be made only by the Contractor and not by Subcontractors, Suppliers, or manufacturers, along with a letter of transmittal to the Engineer, using the form described in Subsection 2-5.3.2 above. Any submittals received directly from the Subcontractors, Suppliers or manufacturers will be rejected and returned to the Contractor.

For product data, the Contractor shall include manufacturers' schematic drawings, catalogue sheets, brochures, diagrams, schedules, performance charts, illustrations, test reports, certificates of compliance, and other descriptive data not included on shop drawings. The Contractor shall modify standard descriptive data to delete information that is not applicable and clearly identify pertinent data. See additional Product Data information in 2-5.6.

2-5.4 Maintenance of Documents *To the SSPWC add subsection 2-5.4 as follows:*

In addition to the provisions in Subsection 2-5.1, the Contractor shall maintain at the Site, one copy of contract Plans, Specifications, Addenda, approved submittals, Change Orders, field memos, RFI's, field test records and other Agency-approved documents submitted by the Contractor in compliance with the Contract Documents.

The Contractor shall designate a person who will maintain As-Built Construction Plans on a daily basis for all information in the field and/or corrections or changes requested by the Engineer. These As-Built Construction Plans must be made available upon request by the Engineer or Inspector. The notes on the As-Built Construction Plans must be verifiable when requested by the Engineer. Failure to maintain an up-to-date set of As-Built Construction Plans may be cause for the Engineer to withhold the monthly payment.

The Contractor shall submit one set of As-Built Construction Plans upon final Project completion. These plans shall include all original permits, including final Building and Safety approval for the Project. As-Built Construction Plans shall not include copies of RFI's, Field Memo's etc. directly attached to the plan, but shall be clearly marked in red ink pen on the Plans, showing the actual installed or deleted Work. Submittal and acceptance of the final As-Built Construction Plans is a condition precedent to the release of retention holdings.

2-5.5 Record Documents and Drawings *To the SSPWC add subsection 2-5.5 as follows:*

The Contractor shall be responsible for maintaining one up-to-date set of Record Drawings at the Site, available for review by the Engineer at all times. The Contractor shall label each document "PROJECT RECORD COPY" in two (2) inch high printed letters. These documents and drawings shall be neat, legible and show all deviations from the original Contract Documents. The Contractor shall not permanently conceal any Work until required information has been recorded.

Prior to monthly payments, Contractor submittals of payment requests shall not be made until the Contractor submits updated Record Drawings to the Engineer for review and approval. The final set of Record Drawings shall be given to the Engineer upon completion of the Work. The Notice of Completion will not be filed until the Engineer receives approved completed Record Drawings.

The Contractor shall legibly mark most appropriate drawings to record, where applicable:

1) Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
2) Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

3) Field changes of dimension and detail made during construction process.
4) Changes made by Change Order or Field Memo.
5) Details not on original contract drawings but approved via shop drawings or the submittal process.

The Contractor shall legibly mark each Specification and Addendum to record:

1) Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2) Other matters not originally specified.
3) Changes made by Change Order or Field Memo.

At completion of Project, the Contractor shall deliver Record Documents and Drawings to the Engineer. Submittal shall be made in duplicate, shall include a transmittal letter, and shall contain:

1) Date, Project title and number.
2) Contractor's name and address.
3) Title and number of each Record Drawing.
4) Certification that each drawing as submitted is complete and accurate.
5) Signature of Contractor or his authorized representative.

[PE: Use this language if it's a Unit Price Contract:]

Full compensation for complying with requirements of this Section, with the exception of maintaining and delivering Record Drawings, shall be considered as included in Contractor's Bid and no additional compensation will be allowed. The Contractor shall be paid under Bid Item "Maintain and Deliver Record Documents" the price as indicated in the "SCHEDULE OF WORK AND PRICES."

[PE: Use this language if this is a Lump Sum Contract:]

Full compensation for complying with requirements of this Section, with the exception of maintaining and delivering Record Drawings, shall be considered as included in Contractor's Bid and no additional compensation will be allowed.

2-5.6 Product Data *To the SSPWC add subsection 2-5.6 as follows:*

Collect Product Data into a submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

1) Manufacturer's printed recommendations.
2) Compliance with recognized trade association standards.
3) Compliance with recognized testing agency standards.
4) Application of testing agency labels and seals.
5) Notation of dimensions verified by field measurement.
6) Notation of coordination requirements.

Modify Product Data sheets to delete information that is not applicable to the Work. Edit all materials to conform to job requirements, and to clearly show model number, type or size proposed. Provide additional information, if necessary, to supplement standard information. The Engineer will return to the Contractor Product Data sheets without review that are submitted with extraneous information not deleted and/or modified. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

Distribution: Furnish copies of the final Product Data submittal to installers, Subcontractors, Suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

Do not proceed with installation until an applicable copy of an Engineer-approved Product Data submittal is in the installer's possession.

2-6 WORK TO BE DONE.. *Delete this SSPWC subsection and replace with subsections 2-6.1 through 2-6.2 as follows:*

2-6.1 General.

[PE: Add a brief paragraph describing general Project scope of Work, specify sequence of Work if applicable:]

The Contractor shall furnish all supervision, labor, materials, tools, equipment and incidentals necessary to construct the project: [Project Name] at [Airport] Airport, and other appurtenant work and incidental work, all as indicated on Drawing No.[ ], Sheets 1 through [ ] and as specified in the Municipal Code, the Standard Specifications for Public Works Construction, 2006 edition as modified by City of Los Angeles Bureau of Engineering Brown Book, as amended and modified herein, and in the Federal Aviation Administration requirements and the specifications as noted herein and the other provisions as specified herein.

[Some work may be accomplished during night work hours and will require tight coordination between airfield operations, field inspectors, suppliers, subcontractors and others. Specific phasing requirements are shown on the plans and discussed in Section 11 of these Specifications.]

Specific work tasks include, but are not limited to [Select / Remove / Modify / Add as appropriate to the project:]:

A. Installation and maintaining construction area barricades, barricade lights, signs and flags.

B. Mobilization and set up of field offices, trailers, [batch plants,] [crushing facilities,] [service roads] and other improvements to the Contractor's staging area.

C. Demolition and removal of existing [asphalt pavement,] [concrete pavement,] [concrete with asphalt overlay pavements,] [including crushing and blending to satisfy Processed Miscellaneous Base requirements.]

D. [Demolition, removal, and/or adjustment of miscellaneous drainage structures.]

E. Demolition, removal and/or relocation of miscellaneous electrical items including signs and lights.

F. Grading, excavation, fill, scarification and compaction of existing subgrade.

G. [Construction of Lime-Treated Subgrade.]

H. Construction of [Crushed Aggregate][Aggregate][Cement-Treated][Econocrete] Base Course, including associated subgrade preparation.

I. [Construction of jointed Portland Cement Concrete pavement.]

J. [Construction of Asphalt Concrete pavement – [base course and] surface course - including subgrade preparation, base and/or subbase courses, prime and tack coats. Some areas must be open to taxiing aircraft between work periods.]

K. [Construction of permanent [and temporary] asphalt shoulder pavement, [erosion control pavement,] [and service roads,] [including aggregate base course,] [PMB base] [or subbase courses,] [cement-treated base course,] and associated subgrade preparation.]

L. [Construction of miscellaneous storm drain [pipes] [and structures,] including [catch basins,] [and manholes]].

M. [Modifications to miscellaneous utility [manholes,] [valves,] [access boxes,] etc. to accommodate changing grades.]

N. Installation of[, and/or modifications to,] various airfield electrical items including [taxiway] [and/or] [runway] [lights,] [signs,] [lighting regulators,] [conduit,] [duct banks,] [pullboxes,] and miscellaneous electrical work.

O. [Construction and maintenance of an unpaved haul road for the Contractor's use.]

P. [Installation of[, and/or modifications to,] vault electrical equipment.]

Q. [Installation and/or relocation of various Navigational Aid systems (NAVAIDS). This work requires a highly specialized and experienced subcontractor.]

R. [Installation [and/or relocation] of various fiber optic systems. This work requires a highly specialized and experienced subcontractor.]

S. [Modifications to the Airport Lighting Control System (ALCS). This work requires a highly specialized and experienced subcontractor.]

T. [Temporary and] [permanent] pavement marking.

U. Temporary [and permanent] erosion control measures.

V. [Seeding]

W. [Other Work - Describe]

X. Other appurtenant work and incidental work, all as indicated on Drawing No. [ ], Sheets 1 through [ ] and as specified in the Municipal Code, the Standard Specifications for Public Works Construction, 2009 edition, as amended and modified herein, and in the Federal Aviation Administration requirements and specifications as noted herein and other provisions as specified herein.

The Work shall include the furnishing of all labor, materials, supervision, tools, equipment, services and incidentals necessary to prescribe and provide for the complete and finished performance of and accomplishment, in every respect, of the entire contemplated Work or improvement indicated by the Contract Documents relating directly to this particular Project; and it shall be understood that the Contractor undertaking the execution of all or any part of such Work or improvement will be required to perform, construct and complete the same in a thorough, satisfactory, and skillful manner in accordance with the provisions of the Contract Documents.

2-6.2 Site Investigation.

The Contractor shall investigate the Site to ascertain conditions affecting necessary procedure and sequence of Work operations for execution of the Contract, and to ascertain Site conditions, character, quality and quantity of surface and subsurface materials that will be encountered. The Contractor shall verify all dimensions in the field and shall check field conditions continuously during construction. The Agency assumes no responsibility whatsoever with respect to the

Contractor's interpretation of subsurface investigations. There is no guarantee or warranty, either expressed or implied, that conditions indicated in the Contract Documents, are representative of those existing throughout the Work, or any part of it, or that unexpected developments may not occur.

2-6.3 Contractor's Operations and Storage Yard.

Storage of equipment and materials left overnight shall be in the area designated by the Engineer. Areas adjacent to the construction will be made available for temporary use by the Contractor without cost whenever such use will not interfere with other purposes, although the Contractor shall be liable for any damage caused to such premises or areas.

2-7 SUBSURFACE DATA. *To this SSPWC subsection add the following:*

[PE: If subsurface data is available, add the following; otherwise state that no data is available.]

Certain test borings were made on the Site by [insert name]. [The boring logs are contained on sheets [ ] through [ ] of the Contract Drawings.] The said investigations of subsurface conditions were made for the purposes of design studies and the Agency assumes no responsibility whatsoever for the Contractor's interpretation thereof. There is no guarantee or warranty, either expressed or implied, that conditions indicated are representative of those existing throughout the Work, or any part of it, or that unexpected developments may not occur.

Copies of the following reports are available for the Contractor's review and information at the offices of the Los Angeles World Airports, 7301 World Way West, 5th floor, Los Angeles, CA, during normal business hours:

[PE: Insert names of reports here.]

2-8 RIGHT-OF-WAY. *This subsection applies as written in the SSPWC.*

2-9 SURVEYING.

2-9.1 Permanent Survey Markers. *Delete this SSPWC subsection and replace with the following:*

[PE: If Contractor will be responsible for survey, add the following. Otherwise keep Greenbook language and edit subtitle and Subsection headings.]

The Contractor shall be responsible for the preservation of survey monuments and bench marks except as noted herein. Where monuments are to be removed or damaged by the Contractor, the Contractor shall notify the Engineer in writing seven (7) Days before starting the Work.

At least two (2) Working Days before the start of construction, the Contractor shall submit

acceptable pre-construction survey tie notes to the Engineer's office. These survey tie notes will be for all survey markers or bench marks that may be lost or disturbed due to construction. Lost or disturbed monuments shall be replaced at the Contractor's expense by a California licensed Land Surveyor or registered Civil Engineer authorized to practice land surveying. Post construction survey monument ties acceptable to the Engineer shall be submitted to the Engineer before the completion of the Work (see "Monuments," Section 8771, Land Surveyors Act, Division 3, Chapter 15 of the Business and Professions Code).

Survey provided by the Contractor shall be certified and stamped by a licensed surveyor in the state of California.

2-9.2 Survey Services by Contractor. *Delete this SSPWC subsection and replace with the following:*

Unless otherwise specified, the Contractor will perform and be responsible for the accuracy of surveying necessary to adequately construct the Project per the Contract Documents. All Work under this Section shall be accomplished by or under the direct supervision of a Surveyor with a current California land surveyor license or a registered Civil Engineer authorized to practice land surveying in the State of California.

The Surveyor shall be approved by LAWA and shall be on site whenever surveying activities are occurring. Within 5 days of Notice of Award, the resume and qualifications of the proposed Surveyor shall be submitted for review and approval. The Contractor shall not subcontract with a Surveyor until this approval is received.

The Contractor shall provide all reference stakes and form checks necessary for construction and inspection of the Work. The Contractor shall preserve construction survey stakes and marks for the duration of their usefulness. All construction staking shall be documented in survey field notes, which shall be made available to the Engineer and Inspector upon request. Except as otherwise specified, stakes shall be set and stationed by the Contractor as follows:

1) For items that include, but are not limited to, curbs, headers, sewers, storm drain Site structures, pavement finish grades, and rough grade with corresponding cut or fill to finished grade (or flow line) indicated on a grade sheet.
2) At a distance according to the City of Los Angeles, Bureau of Engineering, Standard Intervals for Construction, Part J, Survey (Please see Appendix [ ]).
3) A reference or grade stake for each grade change or angle point on the Plan, Standard Plan, and shop drawing, in addition to the normal staking interval stipulated herein.
4) For all utilities, public or private, that require location or relocation.
5) Contractor shall provide copies of survey notes to be included in the QC daily reports as specified in Section 12 of these specifications.

The Contractor shall establish the building baseline, building corners, and an elevation benchmark for building construction. The Contractor's Surveyor shall lay out the building construction and all Work, set grades, lines, levels and positions throughout, including the

inverts or lines and grades for underground piping and conduits, and measure and monitor the actual lines, grades, elevations, and measurements of constructed Work for the purposes of determining any construction errors or deficiencies and for the record drawings. Before starting the Work, the Contractor and Surveyor shall locate general reference points, establish monuments, and take such action as is necessary to prevent their destruction; then lay out all the required lines, elevations, and measurements. The Contractor shall verify figures and dimensions shown on the plans and shall accept all responsibility for any error resulting from failure to so verify.

See Section 18, Location of Underground Utilities, for requirements relative to potholing and determining location of utilities.

The Contractor's Surveyor shall perform and/or supervise all surveying Work required by this Contract including the setting of grade stakes. The Contractor's Surveyor shall be on-Site and available during the Contractor's working hours to complete all necessary surveying Work, including setting of stakes as well as monitoring actual construction for the purpose of determining grades, soil quantities, keeping As-Built Construction Plans and ensuring there are no construction errors. The Contractor's Surveyor shall survey the elevation and alignment of all PCC forms prior to the placement of concrete. The Engineer or Inspector may, at his/her discretion, direct the Contractor to perform additional survey Work as he/she deems necessary to verify accuracy of construction Work. Any delay due to the unavailability of the Surveyor to perform Work as requested shall be the sole responsibility of the Contractor.

At least fourteen (14) days prior to the start of each phase of the Work, the Contractor shall survey all the existing join elevations for said phase. There may be some discrepancy between the existing join elevations and those shown on the Plans. Any discrepancy between elevations shown on the Plans and the field elevations noted by the Contractor shall be brought to the attention of the Engineer immediately. If necessary, the Engineer will modify the grading plans. Survey of elevation of base materials under proposed pavement joints and finished grade elevations of pavement joins shall be provided to the engineer to verify contract compliance.

If no pay item is provided in the Contract for survey Work, full compensation for such work shall be considered as included in the prices bid for other items of Work. No time extension or extra payment will be made if revisions to the grading plans are required.

Surveying as necessary for setting out, checking, determining quantities and control of the Work shall be considered incidental to other items of Work and will not be measured for payment. The Contractor may be required to furnish additional survey Work, such as profiles, restakes, and Change Orders at the request of the Engineer or Inspector. The Contractor shall keep complete survey notes. Copies of these notes and corresponding grade sheets shall be made available to the Inspector and/or the Engineer daily. Upon completion of the Project, the original survey notes shall become the property of LAWA and shall be delivered to the Engineer along with the As-Built Construction Plans. A copy of the horizontal and vertical controls that were established shall be provided to the Engineer.

A licensed surveyor shall be on site whenever surveying activities are occurring.

2-9.3 Private Engineers or Land Surveyors. *Delete this SSPWC subsection and replace with the following:*

Surveying shall be performed by a California licensed Land Surveyor or registered Civil Engineer authorized to practice land surveying in California. Surveying Work shall conform to the quality and practice required by the Engineer.

2-9.4 Line and Grade. *To this SSPWC subsection add the following:*

Unless otherwise specified, stakes will be set and stationed for any structures or construction items indicated in the Contract Documents and a corresponding cut-or-fill to the referenced point indicated on a grade sheet.

2-10 AUTHORITY OF THE BOARD AND ENGINEER. *To this SSPWC subsection add the following:*

The Executive Director is authorized to approve necessary changes in plans up to $100,000 in cost, and to initiate changes in plans or the scope of the Work above $100,000, for submission to the Board for final action.

The Engineer is authorized to enforce compliance with the Contract Documents, to determine the acceptability of materials and quality of Work, to administer requirements with respect to subcontracts, to approve accredited testing laboratories and to prepare and process progress payment estimates.

2-11 INSPECTION. *Delete this SSPWC subsection and replace with the following:*

The Engineer is authorized to enforce compliance with the Contract Documents, to determine the acceptability of materials and the quality of Work. The Engineer is authorized to sample and test all materials to be incorporated into the Work. The Engineer may delegate the authority to sample materials for construction and request the Los Angeles Department of General Services, Standards Laboratory, or an approved private testing laboratory to perform any necessary tests.

The Work shall be conducted under the general observation of the Engineer and shall be subject to inspection by the Inspector to ensure compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, and shop or field inspection, as required. The Engineer shall be permitted access to all parts of the Work, including plants where materials or items are manufactured or fabricated. All materials and fabricated items furnished by the Contractor shall be subject to inspection in accordance with Subsection 4-1, and no materials or fabricated items shall be used in the Work until they have been inspected and accepted by the Engineer.

No Work shall be backfilled, buried, cast in concrete, hidden or otherwise covered until it has

been inspected by the Engineer, and other Agencies for which a permit is required. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under the Contract, the Contractor shall notify the Engineer not less than forty-eight (48) hours in advance to request inspection before beginning any such Work. Failure of the Contractor to notify the Engineer at least forty-eight (48) hours in advance of any such inspections shall be cause for the Engineer to require a sufficient delay in the progress of Work to allow time for such inspections and any remedial or corrective Work required. All costs of such delays, including its effect upon other portions of the Work, shall be borne by the Contractor. Any Work so covered in the absence of inspection shall be subject to uncovering at the sole expense of the Contractor.

Where Work that was done without inspection cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection, and no additional payment will be allowed therefor.

Whenever the Contractor intends to carry on the work of this Contract on a Sunday, or holiday, or more than the specified daytime shift on Monday through Saturday, or any variation in the time of the workday as set forth in these Specifications, length of the workday and work week, notification shall be given to the Engineer of such intention at least 48 hours in advance so that inspection may be arranged. Inspection costs during these times shall be paid by the Contractor at a rate equal to the Engineers actual hourly salary times a 2.75 benefit multiplier. No work shall be allowed during these times without inspection and the prior approval of the Engineer.

Whenever the Contractor schedules work which requires City personnel to be present for testing, inspection or other similar work, and the Contractor fails to have the work performed, the Contractor shall be liable for all City personnel costs.

Scheduling, coordination, and cost of all Building and Safety inspections shall be the responsibility of the Contractor and shall occur between the hours of 7:00 a.m. and 3:00 p.m. In the event the Contractor schedules off hours inspections, the Contractor will also be responsible for the additional premium charges.

The presence of the Engineer or the Inspector shall not relieve the Contractor of the responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and any act or omission on the part of the Engineer or the Inspector shall not avoid said duty. If the Contractor fails to replace any defective or damaged Work or material after reasonable notice, the Engineer may cause such Work or materials to be replaced. The replacement shall be deducted from the amount to be paid to the Contractor; otherwise the Contractor shall pay the Agency if there remains an insufficient amount or no amount to be paid by the Agency to the Contractor.

The Engineer shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the Site. If the Engineer or the Inspector, through an oversight or otherwise, has not rejected materials or Work which is

defective or which is contrary to the Contract Documents, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by the Engineer upon discovery. The Contractor shall promptly remove rejected articles or materials from the Site of the Work after notification of rejection. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the Contractor.

At the completion of Work, after completion of all corrections, the Inspector, the Engineer, and the Contractor will make a final inspection, as applicable. The Engineer will provide a Final Inspection Correction List itemizing all Work necessary to complete the Project satisfactorily.

In case of a dispute between the Contractor and the Engineer, the latter is authorized to reject materials or suspend the Work until any questions at issue can be referred to and decided by the Engineer.

General inspection by LAWA personnel will be provided at no additional cost to the Contractor, except as specified elsewhere in the Contract Documents.

2-12 MATERIAL AND EQUIPMENT SUBSTITUTIONS. *To the SSPWC add subsection 2-12 as follows:*

Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered "substitutions." All such Substitutions shall be submitted to the Engineer no later than fifteen (15) Days after the Notice to Proceed. The Contractor shall bear all consequences for substitutions including re-phasing, cost, time delay, samples, approvals, etc.

The Contractor's Substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements

1) Extensive revisions to Contract Documents are not required.
2) Proposed changes are in keeping with the general intent of Contract Documents.
3) The request is timely, fully documented and properly submitted.
4) The request is directly related to an "or Equal" clause or similar language in the Contract Documents.
5) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
6) The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested Substitution can be approved.
7) A substantial advantage is offered the City, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities The Engineer may be required to bear. Additional responsibilities for the Engineer may include additional compensation to the City for redesign and

evaluation services, increased cost of other construction by the City or separate Contractors, and similar considerations.

8) The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the Substitution will overcome the incompatibility.
9) The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed Substitution can be coordinated.
10) The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed Substitution provides the required warranty.

The Contractor's submittal and Engineer's acceptance of Shop Drawings, Product Data or samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for Substitution, nor does it constitute approval. Substitutions will not be considered for acceptance when:

1) They are indicated or implied on submittals without a formal request from the Contractor.
2) They are requested directly by a Subcontractor or supplier.
3) Acceptance will require substantial revision of the Contract Documents.

Substitute products shall not be ordered without written acceptance of the Substitution by the Engineer.

Contractors Representation: Requests for "or equal" Substitutions constitute a representation that the Contractor:

1) Has investigated proposed Substitution and determined it meets or exceeds, in all respects, the requirements of the Construction Documents.
2) Will provide same warranty for Substitution as for specified product.
3) Will coordinate installation and make other changes which may be required for Work to be complete in all respects.
4) Waives Claims for additional costs and time impacts which subsequently become apparent.

2-13 PROGRESS PHOTOGRAPHS. *To the SSPWC add subsection 2-13 as follows:*

Prior to the start of any construction Work, photographs shall be taken in sufficient number and as directed by the Engineer to show the existing conditions on and adjacent to the Site. The Contractor shall be required to take [six (6)] [ten (10)] progress photographs for each two-week period until the Work is completed. The photographs shall be taken from points designated by the Engineer. The Contractor, at its expense, shall furnish the Engineer with the negative and three (3) color glossy prints for each negative, and deliver them to the Engineer within one week of being taken. The prints shall be eight and one half (8 ½) by eleven (11) inches, mounted on muslin or double weight glossy paper, allowing an inch flap on the wide end for binding. On the back of each print, permanently mark the job name, address, date, description of Work

photographed, location from which taken identified on a key plan, direction in which the camera was pointed and the Contractor's name. Negatives shall become the property of the Engineer.

2-14 PROJECT MEETINGS. *To the SSPWC add subsection 2-14 as follows:*

2-14.1 General. This Subsection specifies administrative and procedural requirements for Project meetings including but not limited to:

1) Pre-Scheduling Conference.
2) Pre-Construction Conference.
3) Coordination Meetings.
4) Daily Meetings.
5) Weekly Progress Meetings
6) Weekly Schedule Meetings.
7) Pre-installation Conferences.

2-14.2 Pre-Construction Conference.

Within twenty (20) Days after the Award of Contract or at least seven (7) Days prior to Notice to Proceed, the Engineer will schedule a Pre-Construction conference.

Attendees: The Engineer and its Construction Manager and/or Design Consultants, the Contractor and its Project Manager, Superintendent, major Subcontractors, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

Agenda: Discuss items of significance that could affect progress including such topics as:

1) Tentative demolition Work schedule.
2) Critical Work sequencing.
3) Designation of responsible personnel.
4) Procedures for processing decisions and Change Orders.
5) Procedures for processing Applications for Payment.
6) Distribution of Contract Documents.
7) Submittal of Shop Drawings, Product Data and Samples.
8) Preparation of Record Drawings.
9) Coordination with other contracts/personnel.
10) Office, Work, and storage areas.
11) Equipment deliveries and priorities.
12) Safety procedures.
13) Security.
14) Housekeeping.
15) Working hours.

2-14.3 Coordination Meetings

Supplement progress meetings and preinstallation meetings with coordination meetings as required to ensure careful coordination of various activities involved.

Request representation at each meeting by every party currently involved in coordination or planning for construction activities involved.

Meeting results will be distributed to everyone in attendance and to others affected by decisions or actions resulting from each meeting by the Engineer.

2-14.4 Progress Meetings.

The Engineer will schedule and administer weekly progress meetings. Progress meetings shall be at the job Site in office space provided by the Contractor. Minutes of each meeting will be distributed to those in attendance by the Engineer to those in attendance.

Attendees: In addition to the Engineer and its Construction Manager and/or Design Consultants, the Contractor shall attend with applicable Subcontractors, or other entity concerned with current progress or involved in planning, coordination or performance of future activities, familiar with the Project and authorized to conclude matters relating to progress.

Agenda: Agenda items include reviewing, correcting or approving minutes of the previous progress meeting and reviewing other items of significance that could affect progress. Include topics for discussions as appropriate to the current status of the Project such as:

1) Contractor's Construction Schedule: The Contractor shall prepare a two week look-ahead schedule to be distributed at each weekly progress meeting. This schedule shall show all items of Work to be performed in the two (2) weeks following the meeting and the work performed in the one week prior to the meeting. Include schedule activity numbers in the two-week look-ahead schedule. During the weekly progress meeting, review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead of or behind schedule. Determine how Work behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
2) Review the present and future needs of each entity present, including such items as:
    a) Interface requirements.
    b) Time.
    c) Sequences.
    d) Hazardous Materials.
    e) Access
    f) Site utilization.
    g) Temporary facilities and services.
    h) Hours of Work.

i) Hazards and risks.
j) Housekeeping.
k) Quality and Work standards.
l) Change Orders.
m) Documentation of information for payment requests.

3) Project Costs: Budget, commitment and progress payments.
4) Project Record File additions (Change Orders, meeting minutes, etc.).
5) Payment Requests.

[2-14.5 Preinstallation Conferences

Conduct preinstallation conference at Project Site before each construction activity that requires coordination with other construction.

Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by installation, and its coordination or integration with other materials and installations that have preceded or will follow. Advise Engineer of scheduled meeting dates.

1) Review progress of other construction activities and preparations for particular activity under consideration at each preinstallation conference, including, but not limited to, requirements for following, as applicable:

a) Contract Documents.
b) Installation Options.
c) Related Change Orders.
d) Purchases.
e) Deliveries.
f) Shop Drawings, Product Data, and quality-control samples.
g) Review of mockups.
h) Possible conflicts.
i) Compatibility problems.
j) Time schedules.
k) Weather limitations.
l) Manufacturer's recommendations.
m) Warranty requirements.
n) Compatibility of materials.
o) Acceptability of substrates.
p) Temporary facilities.
q) Space and access limitations.
r) Governing regulations.
s) Safety.
t) Inspecting and testing requirements.
u) Required performance results.
v) Recording requirements.
w) Protection.

2) Minutes of meeting will be distributed to those in attendance and other interested parties by Engineer.
3) Do not proceed with installation if conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.]

2-15 TECHNICAL MANUALS. *To the SSPWC add subsection 2-15 as follows:*

Before final payment, the Contractor shall prepare and deliver to the Engineer, four (4) copies of operations and maintenance manuals. The manuals shall contain, but not be limited to, installation, instruction, start-up and shut-down procedures, operating and maintenance procedures, illustrations, drawings, tests, adjustments, safety precautions, and parts lists for all machinery apparatus and equipment. The manual shall also contain "AS BUILT" electrical schematics on all equipment and control circuitry.

The manuals shall be approved and stamped by the respective Subcontractors.

The manual shall be bound in a three-ring, loose-leaf binder with maintenance manual letters on the front cover. No sheets larger than eight and one-half (8 ½) by eleven (11) inches should be used. If larger sheets are required for clarification, they shall be folded to this size and used as a pullout.

2-16 NOTICES AND CORRESPONDENCE. *To the SSPWC add subsection 2-16 as follows:*

During the term of the contract, all correspondence, requests for information and approvals, and payment requirements related to this Project shall be addressed to:

Chief Airports Engineer
7301 World Way West, 5th Floor
Los Angeles, California 90045

Unless otherwise approved by the Engineer, all communications from the Engineer will be sent to the Contractor's field office at the Site. The Contractor will make arrangements for U.S. Postal Service delivery at his/her field office.

2-17 SECURITY SERVICES *To the SSPWC add subsection 2-17 as follows:*

During the term of the contract, the Contractor shall provide all services required by the plans, or as described in the specifications, to ensure airport security, in accordance with FAA, and LAWA regulations, as it relates to the Contractor's operations.

2-18 COMPENSATION

Full compensation for complying with the requirements of this Section, except as noted in the

bid items listed below, shall be considered as included in Contractor's Bid and no additional compensation will be allowed.

Payment will be made under:

Item 2.1	Maintain and Deliver Record Drawings	.....per lump sum
Item 2.2	Survey Services	.....per lump sum
Item 2.3	Security Services	.....per lump sum

END OF SECTION 2

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SECTION 3 - CHANGES IN WORK

3-1 CHANGES REQUESTED BY THE CONTRACTOR.

3-1.1 General. *To this SSPWC subsection add the following:*

All changes and Substitutions shall be requested in writing by the Contractor to the Engineer. The request shall include an itemized cost proposal indicating a reduction in cost and time to the Contract or no additional cost and no additional time, including all appropriate backup. If such change is approved by the Engineer, the Contractor shall accept full responsibility for cost and time impacts affected by the change.

3-1.2 Payment for Changes Requested by the Contractor. *This subsection applies as written in the SSPWC.*

3-2 CHANGES INITIATED BY THE AGENCY.

3-2.1 General. *To this SSPWC subsection add the following:*

[Unless the Contractor is directed to perform work on a Time and Materials basis, within] [Within] fourteen (14) Days of written notification by the Agency of a request for quotation, the Contractor shall provide the Engineer a detailed cost proposal for the purpose of evaluating proposed prices for changes to Plans, Specifications, character of the Work, or quantity of the Work as specified by Subsection 3-3.2.2 and elsewhere in the Contract Documents. The cost proposal shall be in such a form and have sufficient details as to clearly indicate separate cost breakdowns for labor by craft, materials by item, supervision, tools, equipment rental, other items and expenditures, markup and bond. If the proposed change will cause an impact to the critical path of the Project, the proposal must include a detailed Time Impact Analysis per Section 19 of this document.

It is the intent of the Agency to settle each Change Order full and final at the time the Change Order is issued. Therefore the following paragraph will be incorporated in writing on all Change Orders:

> *"The undersigned hereby proposes and agrees to furnish any and all labor, material and Equipment, including all overhead and profit, in strict accordance with the requirements of the original Contract Documents except as specifically above noted otherwise, required in Connection with the above proposed changes, for the sum stated above. By signing the Change Order, the Contractor acknowledges and agrees, on behalf of itself, all Subcontractors and All Suppliers, that the stipulated compensation constitutes payment in full for all work contained in the Change Order, plus all payment for the interruption of schedules, extended overhead costs, Delay, all impacts, and ripple effect of cumulative impact on all other work under this Contract. The signing of the Change Order indicates that the Change Order constitutes the Compensation (time and/or cost)*

set forth in the Change Order and comprises the total Compensation due the Contractor, all Subcontractors, and all Suppliers, for the work or change Defined in the Change Order, including impact on unchanged work. It is further understood and agreed that payment under this Change Order constitutes a full mutual accord and Satisfaction for the change, and that payment of the Change Order constitutes the total Equitable adjustment owed the Contractor, all Subcontractors, and all Suppliers, as a result of the changes. The Contractor, on behalf of the Contractor, all Subcontractors, and all Suppliers, agrees to waive all rights, without exception or reservation of any kind whatsoever, to file any further claims related to this Change Order. No further claims or requests for Equitable adjustment of any type shall arise out of or as a result of this Change Order or the Impact of this Change Order on the remainder of the work under the Contract. The Contractor further agrees to fully defend, indemnify and hold the Agency and its agents, employees and assigns harmless, to the fullest extent permitted by law, from any and all Claims, lawsuits, requests for equitable adjustments, damages, attorney's fees and/or other costs raised by Subcontractors or Suppliers, at any tier, as a result of the work under this Contract. The Contractor, on behalf of itself, the Contractor, all subcontractors, and all Suppliers, expressly waives the benefits of the Provisions of Section 1542 of the Civil Code, which reads as follows: "A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS WHICH THE CREDITOR DOES NOT KNOW OR SUSPECT TO EXIST IN HIS FAVOR AT THE TIME OF EXECUTING THE RELEASE, WHICH IF KNOWN BY HIM MUST HAVE MATERIALLY AFFECTED HIS SETTLEMENT WITH THE DEBTOR." The Owner and the Contractor hereby agree that this Change Order Constitutes full mutual accord and satisfaction for all time, all costs, related directly to This Change Order. However, by entering into this Change Order, the parties do not intend to alter, amend, or affect in any way, the warranty and indemnification provisions contained in the prime contract or any amendments thereto. Further, this Change Order does not, in any way, release the Contractor, its subcontractors and/or any and all Suppliers from their respective legal liability, of any kind, to the Owner for their respective work, activity or participation under this Contract."

The Engineer's request for quotation shall not be considered authorization to proceed with the changed Work prior to the issuance of a formal Change Order unless directed otherwise in writing by the Engineer. Such request shall not constitute justification for a delay to the existing Work or a time extension under the Contract.

3-2.2 Payment.

3-2.2.1 Contract Unit Prices. *This subsection applies as written in the SSPWC.*

3-2.2.2 Stipulated Unit Prices. *This subsection applies as written in the SSPWC.*

3-2.2.3 Agreed Prices. *After the first sentence in this SSPWC subsection add the following:*

Agreed prices shall be established prior to commencement of the Work, unless otherwise

approved by the Engineer.

3-3 EXTRA WORK.

3-3.1 General. *This subsection applies as written in the SSPWC.*

3-3.2 Payment.

3-3.2.1 General. *This subsection applies as written in the SSPWC.*

3-3.2.2 Basis For Establishing Costs. *This subsection applies as written in the SSPWC.*

3-3.2.3 Markup. *Delete this SSPWC subsection and replace with the following:*

The markups specified in Parts (a) and (b) below shall be considered as including, but not limited to, the Contractor's labor costs for personnel not working directly on the "extra Work," including the cost of any tools, equipment, and supervisors/superintendents which they may use. Such costs shall not be reported as labor or equipment costs elsewhere except when they are actually used to physically construct the "extra Work." Labor costs shall in that case be reported for the labor classification corresponding to the type and nature of "extra Work" done.

1) **Work by Contractor.** The following percentages shall be added to the Contractor's costs as determined under Subsection 3-3.2.2 and shall constitute the markup for all overhead and profits:
   (1) Labor..... 20
   (2) Materials…….. 15
   (3) Equipment Rental…… 15
   (4) Other Items and Expenditures … 15

   To the sum of the costs and markups provided for in this Subsection, one percent (1%) shall be added as compensation to the Prime Contractor for bonding.

   The following percentages shall be applied to all deductive Change Orders in the Contractor's Work and shall constitute the markup for all deductive Change Orders:
   (1) Labor.....… 10
   (2) Materials…….. 7.5
   (3) Equipment Rental…… 7.5
   (4) Other Items and Expenditures … 7.5

(b) **Work by Subcontractor.** When all or any part of the "extra Work" is performed by a Subcontractor, of any tier, the markup established in Subsection 3-3.2.3 (a) shall be applied to the net amount of the Subcontractor's actual cost of each additive Change Order, to which a markup of ten percent (10%) on the first two thousand ($2,000) of the subcontracted portion of the "extra Work" and a markup of five percent (5%) on Work added in excess of two thousand ($2,000) of the subcontracted portion of the "extra

Work" performed by that Subcontractor may be added by the Contractor. Regardless of the number of hierarchical tiers of Subcontractors, the markup on Subcontractor's costs may only be applied once for each Change Order.

[PE: For Projects greater than Twenty-Five (25) Million, you may want to use the alternative language outlined below for the Change Order Project, replacing 3-3.1 through 3-3.2.3 above.]

[3-3.1 General. *To this SSPWC subsection add the following:*

Subject to all charter limitations, including those on competitive bidding, the Engineer may, at any time during the progress of the work, order alterations in, additions to, deviations or omissions from the Work contemplated by the original Contract Documents

No extra work shall be performed or change be made unless in pursuance of a written order from the Engineer stating that the "extra Work" or change is authorized and no claim for an addition to the Contract amount shall be valid unless the "extra Work" or change is so ordered. Each change will be identified by a Change Order Request Number.

If any change involves an increase or decrease in the cost of the Contractor's Work, the Change Order shall state the amount to be added to or deducted from the Contract amount, and shall also state the additional time, if any, needed for the performance of the Work.

Any change to the Contract amount shall be in a lump sum mutually agreed to by the Contractor and the Owner, except that when, in the opinion of the Engineer, such basis is not feasible, the change to the Contract amount shall be determined upon a cost-plus-percentage basis.
Each lump sum quotation from the Contractor shall be accompanied by sufficient detailed estimates to permit verification of the total.

When the Work is to be done on a cost-plus-percentage basis, the Contractor shall submit daily statements to the Engineer showing all labor, materials, and equipment costs incurred, and upon completion of the Work, a summary statement of costs including the appropriate percentage addition shown below.

Estimates for lump sum quotations and accounting for cost-plus-percentage Work shall be limited to direct expenditure necessitated specifically by the subject "extra Work," and shall be segregated as follows:

1) Direct labor (including the itemized time of the Job Superintendent spent solely on the Work of the Change Order) and materials for both temporary and permanent Work with proper allowance for salvage of temporary Work, and including direct engineering expenses.
2) Equipment rental or use allowance.
3) Subcontractor's and Sub-Subcontractor's costs, including their overhead and profit.
4) Social Security and unemployment taxes and other payroll surcharges.

3-3.2 Payment.

3-3.2.1 General. *This subsection applies as written in the SSPWC.*

3-3.2.2 Basis For Establishing Costs. *This subsection applies as written in the SSPWC.*

3-3.2.3 Markup. *Delete this SSPWC subsection and replace with the following:*

Any change in the Work involving both extras and credits shall show a net total cost, including Subcontracts. Allowances for overhead and profit, as specified herein below, shall be applied if the net total cost is an extra; overhead and profit allowances shall not be applied if the net total cost is a credit. The estimated cost of deductions shall be based on labor and material prices on the date the Contract was signed.

(a) **Work by Contractor.** In addition to the direct cost specified above, the Contractor will be paid a lump sum for his/her overhead, profit, salaries, and field office expense, and supervision not applied solely to the Work of the Change Order and bond. Such lump sum shall conform to the following schedule of percentages of the total amount of the said direct expenditures:

Direct Expenditures	Percentage Addition
Under $1,000	20%
$1,000 to $20,000	16%
$20,000 to $100,000	12%
$100,000 to $500,000	10%
$500,000 to $1,000,000	8%
$1,000,000 and greater	6%

(b) **Work by Subcontractor.** Subcontractors and Sub-Subcontractors will be allowed the following percentages for overhead (including bonds) and profit, respectively, on the amount of their direct expenditures:

Direct Expenditures on Change Orders	% for Lump Sum Addition
Under $1,000	15% for Overhead; 10% for Profit
$1,000 to $20,000	13.5% for Overhead; 8% for Profit
$20,000 to $100,000	12% for Overhead; 6% for Profit
$100,000 to $500,000	10% for Overhead; 4% for Profit
$500,000 to $1,000,000	8% for Overhead; 3% for Profit
$1,000,000 and greater	6% for Overhead; 2% for Profit

For work performed by a Sub-Subcontractor, the Subcontractor may add six (6) percent of the Sub-Subcontractor's total for its overhead and profit.

The basis for determining the cost for Sub-Subcontractors shall be the same as for Subcontractors, and no increase shall be allowed, regardless of the number of

layers of Subcontractors involved.

For added or omitted work by Subcontractors, the Contractor shall furnish to the Engineer the Subcontractor's detailed estimate of the cost for labor, material, and equipment, including the markup by the Subcontractor for overhead and profit. Such estimate of cost shall be signed by the Contractor. The same requirement shall apply to any Sub-Subcontractor.

(c) **Work by Vendor/Supplier.** For added or omitted Work furnished by a vendor or supplier, the Contractor shall furnish to the Engineer a detailed estimate or quotation of the cost to the Contractor for such Work, signed by the vendor or supplier.]

3-3.3 Daily Reports by Contractor. *To the SSPWC subsection add the following as the first sentence:*

The Contractor shall notify the Engineer and the Inspector at the beginning of each day when "extra Work" is in progress. All daily reports shall be signed by the Engineer for all disputed and Extra Work at the end of each work shift.

3-3.4 Unilateral Change Order. *To the SSPWC add subsection 3-3.4 as follows:*

In case of failure on the part of the Engineer and the Contractor to arrive at an agreement on the amount of credit or extra cost for a proposed change to the Contract Documents, a Unilateral Change Order will be processed in the amount believed by the Engineer to be reasonable, and the Contractor shall proceed with the Work. If the Contractor believes that the amount set forth in the Unilateral Change Order is not a reasonable payment for the Work required, the Contractor may file a Claim and request for review.

The Contractor shall submit all supporting documentation of costs associated with a Unilateral Change Order within fifteen (15) Days of completing Work on the said change.

3-4 CHANGED CONDITIONS. *This subsection applies as written in the SSPWC.*

3-5 DISPUTED WORK. *To this SSPWC subsection add the following:*

The Contractor shall submit all supporting documentation of cost associated with a disputed Work within fourteen (14) Days of completing said Work.

For all Claims for additional compensation, the Contractor shall certify, under penalty of perjury, that the Claim has been thoroughly prepared and has merit to its full value.

END OF SECTION 3

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SECTION 4 - CONTROL OF MATERIALS

4-1 MATERIALS AND WORKMANSHIP.

4-1.1 General. *To this SSPWC subsection add the following:*

Work that has been rejected by the Engineer or Inspector shall be remedied, or removed and replaced by the Contractor in an acceptable manner, and no added compensation will be allowed for such removal, replacement, or remedial Work. Work done beyond the areas indicated or established by the Engineer, or any "extra Work" done without written authority will be considered as unauthorized Work. Work shall be remedied, removed or replaced at the Contractor's expense. Upon failure of the Contractor to comply with an order under this Subsection, the Engineer will cause rejected or unauthorized work to be remedied, removed, or replaced, and the cost of the Work shall be deducted from any moneys due or to become due to the Contractor.

If the Contractor shall join Work with that of any other Contractor, or with any Work in place, and if such joint is not made in a skillful manner, or is not otherwise in conformity with provisions of the Contract, then such joint or Work shall be deemed and construed to be faulty workmanship and such materials shall be deemed and construed to be defective materials.

Except as set forth in this Subsection, all non-conforming Work and materials, in place or not, shall be removed immediately from the Site or corrected to conform to all requirements of the Contract Documents, by the Contractor, at the sole expense of the Contractor. If the Contractor fails to remove, replace, or correct any non-conforming Work or materials within seventy-two (72) hours of discovery, the Engineer may cause such Work or materials to be removed and replaced. Such removal and replacement shall be at the sole expense of the Contractor and all such cost shall be deducted from any moneys that are due or may become due to the Contractor. Otherwise the Contractor shall pay the Agency if there remains an insufficient amount or no amount to be paid by the Agency to the Contractor.

Failure of the Inspector or the Engineer to notify the Contractor of any non-conforming Work shall not constitute acceptance of any non-conforming Work. The Contractor's obligation to remove, replace or correct any non-conforming Work, whenever discovered, shall continue to the end of the warranty period specified in the Contract Documents. The Agency reserves and retains all rights and remedies at law against the Contractor and their Surety for correction of any and all latent defects discovered after the warranty period.

Any delays or impacts arising on the Work as a result of construction or delivery of non-conforming Work or materials shall be at the Contractor's sole expense, regardless of whether the Work ultimately becomes the subject of a Change Order, and no time extension shall be allowed to the Contractor.

Workers and installers shall be skilled, trained and experienced in the necessary crafts and shall

be completely familiar with the specific requirements and methods needed for proper performance and completion of the Work.

Fabricators shall be licensed by the City of Los Angeles. All welding shall be performed by welders certified and licensed by the City of Los Angeles, Department of Building and Safety.

No product containing asbestos shall be used for any purpose. When removing asbestos products, the Contractor shall comply with the requirements of Title 8, CCR, General Industry Safety Orders and Construction Safety Orders.

All references to specifications of national organizations and trade associations related to building industry such as, but not limited to, American Society for Testing and Materials, American Institute of Steel Construction, American Concrete Institute, Prestressed Concrete Institute, Post-Tensioning Institute, and the National Board of Fire Underwriters. Refer to the latest revision of such specifications except as otherwise noted.

4-1.2 Protection of Work and Materials. *To this SSPWC subsection add the following:*

1) **Access to Work and Materials.** The Contractor shall provide access at any time to the Work and materials wherever same are stored, being fabricated, erected or installed, when requested to do so by a representative of the Agency or other regulatory subdivisions having jurisdiction.

2) **Facilities and Labor.** The Contractor shall provide sufficient, safe, and proper facilities and labor necessary to move, take and prepare samples for testing of materials, and shall move same for purposes of additional testing when ordered to do so by any of the Agency's representatives.

4-1.3 Inspection Requirements.

4-1.3.1 General. *To this SSPWC subsection add the following:*

All materials and fabricated articles furnished by the Contractor are subject to inspection at their source, and no materials or fabricated articles shall be used in the Work until they have been inspected and accepted by the Materials Control Inspector. The Materials Control Inspector shall be permitted access to all parts of the Work, including shops where materials and fabricated articles are manufactured or fabricated.

All materials and fabricated items shall be manufactured or fabricated from Shop Drawings that have been approved by the Engineer. The Contractor shall ensure that legible copies of the approved submittals, shop drawings, approved mix designs, and/or the corresponding Contract Specifications are provided to its fabricators or suppliers, and that said documents are available to the Materials Control Inspector or Independent Inspection and/or Testing Laboratory (IITL) during the inspection.

Any material or fabricated item which requires shop inspection and arrives at the Site without inspection by the Materials Control Inspector or IITL, will be subject to rejection by the Engineer and may be required to be removed from the Site by the Contractor at the Contractor's sole expense.

Prior to shipment of any material or fabricated item, final inspection shall be performed by the Materials Control Inspector or IITL. Said inspection shall consist of a final visual inspection, identification, and tagging and/or stamping for release to the Project Site. Items received at the Site without the proper identification may be rejected and required to be removed from the Site.

Without waiving any specific requirement of the Contract Documents, Appendix [ ] lists examples of equipment and/or material that are subject to shop inspection. This list may not be all inclusive.

4-1.3.2 Inspection of Materials Not Locally Produced. *Delete this SSPWC subsection and replace with the following:*

When the Contractor intends to purchase materials, fabricated products, or equipment from sources located more than fifty (50) miles from the Project work Site, an Independent Inspection and/or Testing Laboratory (IITL), approved by the Engineer, shall be engaged by the Contractor, at its expense, to inspect and/or test the materials, equipment, or process. This approval shall be obtained before manufacturing or fabricating any material or equipment. The approved inspector or laboratory shall forward all required reports to the Engineer.

The Agency retains the right to perform inspection or testing at such remote sites with Agency personnel. If the Agency exercises this right, the Contractor will be required to pay for all costs associated with this inspection and testing, except the Inspector's wages.

Independent Inspection and/or Testing Laboratory (IITL) Procedures:

1) The Contractor shall submit a request in writing to the Engineer for approval of each IITL at least thirty (30) Days prior to the anticipated start of fabrication. The request shall include the following information:
   a) Complete title of the Project.
   b) Name of proposed testing laboratory or inspection agency. [Note: Certification and/or licensing, issued by the City of Los Angeles, Department of Building & Safety, may be required for some projects.]
   c) Address and telephone number of proposed testing laboratory or inspection agency.
   d) Contact person at proposed testing laboratory or inspection agency.
   e) Description and history of the proposed testing laboratory or inspection agency.
   f) Resume of the inspectors who will perform inspection (minimum of two inspectors, one primary and one alternate, will be required).
   g) Approved submittal number(s) and brief description of item(s) to be inspected or tested or both.

h) Shop Name, contact person, address, and telephone number of shop where item(s) or material will be manufactured or fabricated.

i) Fabrication/manufacturing schedule.

2) The Contractor will be notified in writing of the approval by the Engineer of the IITL within fourteen (14) Days of the start of fabrication.

3) Once the Contractor has received approval of the IITL, the Contractor shall contact LAWA Materials Control at (310) 646-3232 to schedule a pre-fabrication meeting. At a minimum, representatives from the following shall be present at the meeting: Contractor, Subcontractor (if applicable), manufacturer, the IITL, and LAWA Inspection. Items to be discussed will include required inspections, tests, and reports, as based on the approved applicable Submittals and in accordance with the Contract Documents.

4) The Contractor shall provide approved Shop Drawings and the applicable Contract Specifications to the IITL for use in the inspection and testing of the items to be fabricated or manufactured.

5) The IITL shall judge the materials and fabricated articles by the requirements of the Plans and Specifications and approved submittals. The IITL shall forward all required reports to the Materials Control Inspector for review and approval. No materials or equipment shall be shipped nor shall any processing, fabrication and/or treatment of such materials be done without the required inspection by the IITL and approval by the Materials Control Inspector.

6) An approved testing laboratory/inspection agency shall not sublet or assign its work to any other agency and shall take direction from and be responsible to the Inspector. The work and activities of the third party testing laboratory/inspection agency shall be subject to examination and inspection by the Inspector to ensure strict compliance with the Contract Documents.

Approval of an IITL shall not relieve the Contractor of responsibility for complying with the Contract requirements.

4-1.3.3 Inspection by the Agency. *This subsection applies as written in the SSPWC.*

4-1.3.4 Third Party Inspection Requirements. *To the SSPWC add subsection 4-1.3.4 as follows:*

The Contractor shall obtain written approval from the Engineer for proposed use of third party inspectors or testing agency before the start of production of materials or fabrication of any product or equipment. The Contractor's request for approval of a proposed third party inspection agency and/or test laboratory shall be submitted in writing to the Engineer. The Engineer will respond to the Contractor's request in writing.

The Contractor shall follow IITL Procedures in Subsection 4-1.3.2.

All third party inspections shall be at the Contractor's expense.

4-1.4 Testing of Materials. *To this SSPWC subsection add the following:*

1) **Testing by the Agency.** If initial tests made under the direction of the Engineer reveal that the Work does not comply with the Contract Documents, re-testing shall be performed. If re-testing establishes that the Work complies with the Contract Documents, the costs for the re-testing shall be paid for by the Agency. If re-testing establishes that the Work does not comply with the Contract Documents, then all costs associated with the re-testing shall be the borne by the Contractor.

   In addition to any other inspection or Quality Assurance provisions that may be specified, the Engineer shall have the right to independently select, test, and analyze, at the expense of the Agency, additional test specimens of any or all of the materials to be used. Whenever any portion of the Work fails to meet the requirements of the Contract Documents as shown by the results of independent testing or investigation by the Engineer, all costs of such independent inspection and investigation, and all costs of removal, correction, and reconstruction or repair of any such Work shall be borne by the Contractor.

2) **Testing by Approved Testing Laboratory.** When the manufacturer, fabricator, or supplier provides the results of tests from samples taken at the mill, factory, or warehouse, the Engineer will accept the test reports provided the following conditions are met:
   a) The Testing Laboratory was approved by the Engineer prior to performing the tests, and that all necessary certifications were valid at the time the tests were performed.
   b) The tests were performed in conformance with the Contract Documents for the specified material or item.
   c) The reports are made in the form of an affidavit, as specified below.
   d) Tests performed by an approved Testing Laboratory are subject to be monitored by Agency Inspectors.

   Whenever the approved Testing Laboratory takes samples of materials other than at the Site, the deliveries to the Site of materials represented by such samples shall be identified as specified for the specific material. The results of such tests shall be reported to the Materials Control Inspector in the form of affidavits attested to by the Testing Laboratory. Such affidavits shall furnish the following information with respect to the material sampled:
   a) Manufacturer's name and brand.
   b) Place of sampling.
   c) Sufficient information to identify the lot, group, bin, or silo from which the samples were taken.
   d) Amount of material in the lot sampled.
   e) Statement that the material has passed the requirements.
   f) Signature and title of the person creating the affidavit and the date of execution of the affidavit.

4-1.5 Certification. *To this SSPWC subsection add the following:*

A Certificate of Compliance in triplicate shall be furnished prior to the use of materials for which the Contract Documents require that such a certificate be furnished. The Engineer may permit the use of certain materials or assemblies prior to the sampling and testing if accompanied by a Certificate of Compliance. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and the Contractor, and shall state that the materials involved comply in all respects with the requirements of the specifications. A Certificate of Compliance shall be furnished with each lot of materials delivered to the work, and the lot so certified shall be clearly identified on the certificate. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

Materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents and such material not conforming to such requirements will be subject to rejection whether in place or not.

The Engineer reserves the right to refuse to permit the use of material notwithstanding the submittal of a Certificate of Compliance.

4-1.6 Trade Names or Equals. *To this SSPWC subsection add the following:*

The Contractor shall conform to the requirements stated in Subsection 2-12.

4-1.7 **Weighing and Metering Equipment.** *This subsection applies as written in the SSPWC.*

4-1.8 Calibration of Testing Equipment. *This subsection applies as written in the SSPWC.*

4-2 MATERIALS FURNISHED BY THE AGENCY. *To the SSPWC add subsection 4-2 as follows:*

[PE: You may want certain items longer than 30 Days; if so indicate on plans or list specific items here.]

Upon receiving material furnished by the Agency for storage or installation in the Work, the Contractor shall give a signed receipt to the Engineer for the material delivered. Thereafter the Contractor shall be responsible for the care and necessary replacement of such material if damaged.

If, as determined by the Engineer, the material is not adequately protected by the Contractor, such material may be protected by the Agency and the cost thereto be charged to the Contractor or deducted from any payment due.

Upon receiving such material, the Contractor shall inspect it, and should any damage, defects, or missing equipment or parts be found, the Contractor shall immediately notify the Engineer in writing. By failing to notify the Engineer, it shall be deemed that the Contractor has accepted such material as being free from said damage, defects, or missing equipment or parts, except for latent defects.

4-3 SAMPLES. *To the SSPWC add subsection 4-3 as follows:*

Where required in the Contract Documents, or when required by the Engineer, the Contractor shall submit to the Engineer representative samples of materials to be included in the Work. Except where otherwise specified, four (4) samples shall be submitted.

The Engineer shall have thirty (30) Days to review a sample. If the sample is rejected, the Engineer shall have thirty (30) Days to review the revised sample. It is the Contractor's responsibility to submit the required samples in a timely manner such that the approval, purchase, and delivery of the material does not delay the Contract.

Samples shall be properly identified, indicating the type and brand of materials, place of origin, the name of the producer, the Contractor's name, the name of the Project for which the material is intended, and the Specifications Section and page number where the material is described. The Contractor shall sequentially number the samples, with revised samples having an alpha suffix.

Materials shall not be installed prior to written approval of the samples by the Engineer. Installed materials shall match the approved samples in all respects.

4-4 YEAR 2000 (Y2K) COMPLIANCE WARRANTY. *To the SSPWC add subsection 4-4 as follows:*

The Contractor represents and warrants that any Products(s) furnished pursuant to this proposal that performs any date and/or time data recognition function, calculation, or sequencing, will:

1) Support a four-digit year format.
2) Be Year 2000 compliant through the year 2030.
3) Provide accurate date/time data and leap year calculations on and after December 31, 1999.
4) Be Year 2000 compliant through the year 2030 at the same level of functionality for which originally acquired without additional cost to the User.

"Product" shall include, without limitation: any piece or component of equipment, hardware, firmware, custom or commercial software, or internal components or subroutines therein. This warranty shall survive termination or operation of the contract, if any, arising form this proposal.

Year 2000 Compliant means the Product(s) will:

1) Function without interruption or human intervention with four-digit year processing on all Date Data, including errors or interruptions from functions

which may involve Date Data from more than one century or leap years, regardless of the data of processing or date of Date Data (the term "Date Data" shall mean any data, input, or output which includes an indication of date).

2) Provide results from any operation accurately reflecting any Date Data used in the operation performed, with output in any form, except graphics, having four-digit years.
3) Accept two-digit year Date Data in a manner that resolves any ambiguities as to century in a defined manner.
4) Provide data interchange in the ISO 8601.1998 standard of CCYYMMDD.

In the event of any decrease in Product functionality or accuracy related to time and/or Date Data related codes and/or internal subroutines that impede the Product from operating correctly beyond December 31, 1999, the Contractor agrees to restore the Product to the same level of functionality as warranted herein or to repair or replace the Product with a conforming Product so as to minimize interruption to the User's ongoing business processes, time being of the essence. In the event that such warranty compliance requires the acquisition of additional programs, in addition to the Contractor's other responsibilities, the expense for any such associated or additional acquisitions that may be required (including, without limitation, data conversion tools) shall be borne exclusive by the Contractor.

END OF SECTION 4

SECTION 5 - UTILITIES

5-1 LOCATION. *To this SSPWC subsection add the following:*

The Contractor, shall expose and verify by survey the depth and alignment of all underground utilities at the Site prior to commencing excavation. The Contractor shall pothole and survey all utilities within a five (5) foot distance of any footing, prior to the excavation for said footing. All such exploratory excavations shall be performed as soon as practical after the Notice to Proceed and in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's Work. When such exploratory excavations show the utility location as indicated on the drawings to be in error, the Contractor shall immediately notify the Inspector and the Engineer and shall note utilities on As-Built Construction Plans. The Contractor should not rely upon plan designation of location of underground utilities. The number of exploratory excavations and extent of potholing required shall be that number which is sufficient to determine the alignment and grade of the utility.

All cost associated with potholing utilities that are shown on the plans shall be considered incidental to associated bid items, and no separate payment shall be made. For utilities not shown on the plans, the Contractor will be paid for potholing under the terms of Section 18.
For utilities not shown on the plans, the Contractor will be paid for potholing under the terms of Section 18.

The Contractor shall contact utility owners after the I.D. number is obtained from the Underground Service Alert (USA) (1-800-227-2600) but not less than fourteen (14) Days before the excavation Work is started, to mark or identify existing utilities. If the utility owner is the City of Los Angeles, a confirmation number indicating that the City has been notified shall be obtained by USA and/or the Contractor from the appropriate City Department. The I.D. number together with the date acquired shall be reported to the Engineer when calling for inspection. Los Angeles World Airports (LAWA) will not mark utility lines owned and maintained by LAWA.

The Contractor's attention is directed to the existence of certain underground facilities that may require special precautions be taken by the Contractor to protect the health, safety, and welfare of workers and of the public. Facilities requiring special precautions include, but are not limited to: conductors of petroleum products, oxygen, chlorine, and toxic or flammable gases; natural gas in pipelines greater than 150 mm in diameter**[, other,]** or pipelines operating at pressures greater than 415 kPa (gage); underground electric supply system conductors or cables, with the potential to ground more than 300 V, either directly buried or in duct or conduit which do not have concentric grounded or other effectively grounded metal shields or sheaths.

The Contractor will be required to mark all FAA utility lines prior to any work in a given area. Marking shall consist of 36 high inch lathe, placed 10 foot on center. Lathe shall be marked with the words “DANGER – FAA” or equivalent, and shall be affixed with red or orange surveyors tape to enhance visibility. No separate payment will be made for this marking, but it shall be considered incidental to other bid items.

5-1.1 Notification by the Contractor:

Prior to any excavation in the vicinity of any existing underground facilities, the Contractor shall notify the Engineer, and the respective authorities representing the owners and agencies responsible for such facilities, not less than 3 working days, nor more than 5 working days, prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire.

[PE: Note any relevant contact information – for example:]

The following includes a list, but is not limited to, of utility companies and representatives whose facilities may be impacted by this Project:

Agency/Company	Contact Name	Phone Number
Chevron Pipeline Co.		(805) 632-1060
LAX Fuel		(310) 646-5915
Pacific Bell		(310) 515-4212
City of L.A., Dept. of Water and Power		
Water		(213) 367-1218
Power		(213) 367-1743

5-2 PROTECTION. *Delete this SSPWC subsection and replace with subsections 5-2.1 through 5-2.2 as follows:*

5-2.1 General.

All utilities encountered along the line of the Work shall be maintained continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the utility owner and the Engineer are made. Utilities shall include, but not be limited to, all above or below ground conduit, pipes, wet wells, ducts, cables, and appurtenances associated with oil, gas, water, steam, irrigation, sewer, storm drain, wastewater, air, electrical, power, instrumentation, communication, telephone, TV, and lighting systems, whether or not owned by the City. All valves, switches, vaults, and meters shall be maintained readily accessible for emergency shutoff.

Where protection is required to ensure support of utilities located as shown on the Plans or in accordance with Subsection 5-1, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at its expense.

Upon learning of the existence and location of any utility omitted from or shown incorrectly on the Plans, the Contractor shall immediately notify the Engineer in writing. When authorized by the Engineer, support or protection of the utility will be paid for as provided in Subsection 3-2.2.3 or Subsection 3-3.

Fire and police call boxes and conduits shall be protected by the Contractor. Should said

facilities be damaged by the Contractor's operations, immediate notification shall be given to the Agency. Damaged facilities will be replaced by the Agency at the Contractor's expense.

When placing concrete around or contiguous to any non-metallic utility installation, the Contractor shall at its expense:

1) Furnish and install a 50mm (2 inch) cushion of expansion joint material or other similar resilient material; or
2) Provide a sleeve or other opening which will result in a 50mm (2 inch) minimum-clear annular space between the concrete and the utility; or
3) Provide other acceptable means to prevent embedment in or bonding to the concrete.

Where concrete is used for backfill or for structures which would result in embedment, or partial embedment, of a metallic utility installation; or where the coating, bedding or other cathodic protection system is exposed or damaged by the Contractor's operations, the Contractor shall notify the Engineer and arrange to secure the advice of the affected utility owner regarding the procedures required to maintain or restore the integrity of the system.

Unless otherwise specified, all underground utility conduits shall have a minimum cover of eighteen (18) inches and shall have identifying detectable tape placed in the trench above the conduit. The detection tape shall be made of metalized foil laminated between two layers of inert plastic film, six (6) inches wide and a minimum of 4.5 mils thick, as described here:

1) Safety Red = Electric and lighting conduit and cables.
2) Safety Yellow = Gas, oil, steam, petroleum or gaseous materials.
3) Safety Orange = Telephone, alarm, or signal cables and conduit.
4) Safety Blue = Potable water or irrigation.
5) Safety Green = Sewer or drain lines.

The detection tape shall be placed directly above and reasonably horizontal for the full length of the conduit. For conduits with less than four (4) feet of cover, install tape four (4) to eighteen (18) inches below the subgrade surface and at least twelve (12) inches above the conduit. For conduits with more than four (4) feet of cover, install tape at least three (3) feet above the conduit.

Upon completion of the Work, the Contractor shall remove all enclosures or protective coverings and leave the work area in a finished condition.

Payment will be made for utility line investigations and/or relocations as noted Section 5-8.

5.2.2 Protection of Existing Utilities:

The Contractor shall protect all existing utilities and improvements not designated for removal. Physical protection of utilities in proximity of pavement sections shall be provided by the Contractor in all cases. Except where noted on the plans, encasement protection of utilities in proximity of pavement sections shall require prior approval of the Engineer.

The Contractor shall determine the exact locations and depth of all utilities indicated on the drawings. In addition to those indicated, the Contractor shall make exploratory excavations of all utilities. All such exploratory excavations shall be performed as soon as practicable after award of the Contract, and in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's work. When such exploratory excavations show the utility locations as indicated on the drawings to be in error, the Contractor shall so notify the Engineer. The number of exploratory excavations required should be that number which is sufficient to determine the alignment of the utility. All costs for such work shall be absorbed by the Contractor.

5-2.3 Damage to Existing Utilities and Improvements.

Any utility or improvement that is damaged by the Contractor shall be immediately reported in writing to the Engineer and Inspector and immediately repaired to a condition equal to, or better than, the condition they were in prior to such damage. Repair Work shall be continuous until the utility or improvement is placed back in service.

The provisions of this Subsection shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

All repairs to a damaged utility or improvement shall be inspected and approved by an authorized representative of the utility or improvement owner before being concealed by backfill or other Work.

In case of damage which in the opinion of the Engineer or Inspector threatens the safety of persons or property, the Contractor shall immediately make all repairs necessary for removal of the hazard. Should the Contractor fail to take prompt action to this end, the Agency has the option to remove any hazard resulting from damages caused by the Contractor without waiving any other rights the Agency may have, and costs shall be charged to the Contractor.

In the event that the Contractor damages any existing utility lines that are not shown on the drawings or the locations of which are not made known to the Contractor prior to excavation, a written report thereof shall be made immediately to the Engineer and utilities shall be immediately repaired as stated above. Such repairs on damaged unknown utilities shall be made by the Contractor under the provisions for Changes In Work, Section 3, of this document.

If, an existing utility or substructure was not shown in the original Contract Documents, but has been made known to the Contractor prior to excavation, the utility or substructure shall be considered as an existing known condition. Under these circumstances, the Contractor shall be responsible for protecting the utility. Damage to a utility, which has been made known to the Contractor shall be repaired at the Contractor's sole cost. The Contractor shall, at its own expense, satisfactorily repair damage to any known pipeline, sewer, conduit, utility, or other underground structure which may result from its operations or negligence. If it is necessary for the Agency to repair such damage, the Contractor shall be billed for and shall pay the actual cost to the Agency for labor and materials plus fifteen percent (15%) administrative costs.

5-3 REMOVAL. *To this SSPWC subsection add the following:*

[PE: Verify that removal boundaries are clearly outlined on the Plans.]

The Contractor shall notify the Engineer, in writing, seven (7) Days in advance of taking any existing utility line out of service. Arrangements satisfactory to the Engineer must be made prior to taking any existing utility line out of service for any purpose. The Contractor shall confirm with the Inspector and the Engineer twenty-four (24) hours prior to disconnect.

The Contractor shall pull out all wire from an electrical duct bank that is being abandoned and disconnect same from servicing panel.

5-4 RELOCATION. *Delete this SSPWC subsection and replace with the following:*

Where the proper completion of the Work requires the temporary or permanent relocation and/or removal of an existing utility or other improvement which is shown on the Plans, the Contractor shall at its own expense, without unnecessary delay, temporarily or permanently relocate or replace such utility or improvement in a manner satisfactory to the Engineer and the Owner of the utility. All cases of such temporary relocation, removal, or restoration shall be accomplished by the Contractor in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

[PE: Note in documents if there are any time constraints on shutdowns – for example:]
All existing utilities being relocated by the Contractor shall not be out of service for more than an 8-hour period. This eight (8) hour shut down period for switch over shall be performed at night.

The Contractor must notify the Engineer thirty (30) Days in advance of any proposed connection and shall notify the Engineer and the Inspector twenty-four (24) hours prior to the actual connection to any existing utility.

Payment will be made for utility line investigations and/or relocations as noted Section 5-8.

[5-4.1 Specific Work Elements

The following do not constitute a complete listing of utility work elements for the Project, but are selected for discussion because of their impact to the overall project.]

[Describe specific utility tasks / conditions / requirements / restrictions unique to the project.]

5-5 DELAYS. *This subsection applies as written in the SSPWC.*

5-6 COOPERATION. *This subsection applies as written in the SSPWC.*

5-7 SCHEDULE COORDINATION

Coordination of work between various utility agencies and work by the Contractor shall be the sole responsibility of the Contractor. Delays to the schedule due to utility agency coordination issues that, in the opinion of the Engineer, could have been prevented by timely intervention and coordination on the part of the Contractor will not be credited to the Contractor's contract schedule requirements.

All costs incurred by the Contractor for coordination with the necessary agencies relative to the work affecting utilities shall be considered incidental to the bid items and no separate payment will be made.

5-8 BASIS OF PAYMENT

No payment will be made for fulfilling the requirements of this sections except for work involved in investigating and relocating unknown utilities (utilities not shown on the plans) which are encountered during the progress of the progress.

Payment will be made under:

Item 5.1 Utility Investigation / Relocation..... per allowance

END OF SECTION 5

SECTION 6 - PROSECUTION, PROGRESS, AND ACCEPTANCE OF THE WORK

6-1 CONSTRUCTION SCHEDULE AND COMMENCEMENT OF WORK. *Delete this SSPWC subsection and replace with the following:*

For specific requirements regarding the construction schedule and related reports, see Section 19.

6-2 PROSECUTION OF WORK. *To this SSPWC subsection add the following:*

The Contractor shall operate at such locations as the Engineer may direct. Should the Work be discontinued for any reason, the Contractor shall notify the Engineer at least twenty-four (24) hours in advance of resuming operations.

[PE: Insert any potential interferences, delivery time constraints, etc. here – for example:]

[In addition, and for information only, the Contractor is advised that Airline Tenants may be undertaking work on existing Terminal Buildings, Caltrans may be undertaking freeway off-ramp improvements (I-105 at Sepulveda Boulevard) and signage improvements along Sepulveda Boulevard. [

[The Contractor or his/her Subcontractors will deliver to the Site all pre-cast members and heavy equipment between midnight and 6:00 a.m. and under escort by the Airport Police. At least forty-eight (48) hours notice shall be given to the Airport Police.]

6-3 SUSPENSION OF WORK.

6-3.1 General. *To this SSPWC subsection add the following:*

The Engineer shall have the authority to suspend the Work wholly or in part, for such period as may be deemed necessary, due to unsuitable weather, or to such other conditions as are considered unfavorable for the prosecution of the Work, or for such time as may be deemed necessary due to the failure on the part of the Contractor to carry out orders given or to perform any provision of the Contract. The suspended Work shall be resumed when conditions are favorable and methods are corrected, as ordered or approved in writing by the Engineer. If the Engineer orders a suspension of all of the Work or a portion of the Work which is the current controlling operation or operations, due to unsuitable weather or to such other conditions as are considered unfavorable to the prosecution of the Work, the Days on which the suspension is in effect shall be considered as non-compensable time extension in accordance with Subsection 6-6. If a portion of Work at the time of such suspension is not a current critical path operation but subsequently does become a current critical path operation, the determination of any time extension will be made in accordance with Subsection 6-6.

[During this project it is anticipated that the work will be suspended at various time throughout the project for the Engineer's convenience. These suspensions may occur up to a maximum of

10 times, for up to **[2]** hours each. The Contractor shall anticipate these various suspensions and any costs associated with these suspensions shall be considered incidental to the various items of work.]

If a suspension of Work is ordered by the Engineer due to the failure on the part of the Contractor to carry out orders given or to properly perform any provision of the Contract, the Contractor will not be granted a time extension for the days on which the suspension order is in effect.

In the event of a suspension of Work under any conditions, such suspension of Work shall not relieve the Contractor of its responsibilities.

6-3.2 Archaeological and Paleontological Discoveries. *This subsection applies as written in the SSPWC.*

6-4 DEFAULT BY CONTRACTOR. *To this SSPWC subsection add the following:*

Failure by the Contractor to conform to the construction schedule referred to in Section 19 may be considered by the Executive Director as a lack of due diligence in prosecuting the Work.

6-5 TERMINATION OF CONTRACT. *To this SSPWC subsection add the following:*

The Agency may terminate the Contract upon written notice to the Contractor if it is found that reasons beyond the control of either the Agency or the Contractor make it impossible, or it is found to be against the best interest of the Agency to continue the Work. In such a case, the Contractor shall have no Claims against the Agency except for the following:

1) Value of Work satisfactorily performed and completed up to the date the Contract is terminated, less payment(s) previously made by the Agency.
2) Cost of material and equipment on hand, in transit, or on definite commitment as of the date the Contract is terminated, which would be needed in the Work and which meet the requirements of the Contract Documents. The Contractor shall provide documentary proof of such items when requested by the Agency.

The value of the Work performed and the cost of materials and equipment delivered to the Site, as mentioned above, shall be determined by the Engineer in accordance with the procedure prescribed in the Contract Documents.

6-6 DELAYS AND EXTENSIONS OF TIME.

6-6.1 General. *Delete the first sentence of the second paragraph of this SSPWC subsection and replace with the following:*

No extension of time will be granted for a delay caused by the inability to obtain materials unless the Contractor obtains from the supplier and furnishes to the Engineer documentary proof that

such materials could not obtained due to war, government regulations, labor disputes, strikes, fires, floods, adverse weather necessitating the cessation of Work, or other similar action of the elements.

6-6.2 Extensions of Time. To this SSPWC subsection add the following:

Extensions of time, when granted, will be based upon the effect of delays to the Work. They will not be granted for non-controlling delays to minor portions of the Work unless it can be shown that such delays did or will delay the progress of the Work.

6-6.2.1 Critical Path Schedule

All Work shall be performed in accordance with the requirements of the Contract and the Critical Path Schedule approved by the Engineer in accordance with Section 19. The Critical Path Schedule shall indicate planned Milestone dates for completing all Contract tasks and the Scheduled Completion Date for completion of all Work, and Contractor shall provide the Agency notice of any Delay in the Critical Path Schedule.

6-6.2.2 Inexcusable Delay

An Inexcusable Delay shall not be a cause for granting additional Contract Time or compensation, and shall be cause for termination of the Contract, if the Engineer chooses to exercise this right, under the Article entitled Termination For Default per Section 6-4 and 6-5.

6-6.2.3 Excusable Delay

A delay to the Critical Path shall be an "Excusable Delay" to the extent that:

Contractor provides notice to the Engineer describing the act or event that Contractor asserts was the cause of the Delay not more than three (3) Days after the day the act or event occurs;

The act or event has caused, or will result in, an identifiable and measurable disruption of the Work, which has consumed all available Float and extended the Work required for Substantial Completion or Final Acceptance beyond the applicable completion deadline;

The Delay to the Critical Path Schedule could not reasonably have been avoided by Contractor, including by re-sequencing, reallocating or redeploying its forces to other portions of the Work;

The act or event, and its causes and effects, were beyond the control of, and were not due to, the fault or negligence of the Contractor, and did not arise out of Contractor's failure to perform or meet the requirements of the Contract;

The act or event causing the Delay is not excluded from Excusable Delays under any other provision of the Contract; and

A specific remedy for the Delay is not provided by any other provision of the Contract.

Contractor shall have the burden of proving the Delay occurred, the Delay was an Excusable Delay (as defined above), the Delay could not be fully mitigated, and the length of time of the Excusable Delay. Contractor will not receive compensation for an Excusable Delay unless it is also a Compensable Delay, as provided in the Section entitled Compensable Delay in this Article. Upon adequate proof of an Excusable Delay, Contractor will be granted an extension of time and will not be assessed with liquidated damages to the extent of the Excusable Delay to the Critical Path Schedule.

6-6.2.4 Force Majeure and Weather

Subject to Contractor meeting the requirements of the Section entitled Excusable Delay in this Article, and the following requirements, Contractor will receive an extension of Contract Time for an Excusable Delay caused by a Force Majeure event or weather if:

Contractor has taken reasonable precautions to prevent further Delays arising out of such Force Majeure event or weather; and

Contractor provides written notice to the Engineer describing the Force Majeure event or weather and the cause(s) of the Delay within three (3) Days after the beginning of such Delay.

The Engineer will grant an extension of time for weather Delays only to the extent the Critical Path Work is actually delayed as determined by the Engineer. Contractor's exclusive remedy for any Excusable Delay arising out of a Force Majeure event or weather shall be an extension of Contract Time, as provided in this Article.

6-6.2.5 Compensable Delay

An Excusable Delay shall be a Compensable Delay if the performance of all or any part of the Work is delayed or interrupted:

By an act of an Authorized Representative of the Agency in the administration of this Contract that is not expressly or impliedly authorized by this Contract, or

By a failure of the Agency to act within the time specified in this Contract, or within a reasonable time if not specified.

A Claim for a Compensable Delay shall not be allowed for any costs incurred more than three (3) Days before the Contractor shall have notified the Engineer of the act or Event causing the Delay.

Contractor will have the burden of proving that the Delay is both an Excusable Delay and a Compensable Delay. If an Excusable Delay is found to be a Compensable Delay, the Agency will, by Change Order, extend the Contract Time for the increase in the time of performance, and will adjust the Total Contract Price (excluding profit). The Change Order will be Contractor's sole remedy arising out of the Compensable Delay.

6-6.2.6 Concurrent Delay

If Contractor is delayed by any act or event that would otherwise be a Compensable Delay, but the Delay is concurrently caused by any Excusable (but not Compensable) Delay or any Inexcusable Delay, Contractor's remedy shall be the same as for an Excusable Delay, and the Agency will, by Change Order, extend the Contract Time. Contractor will not be entitled to any change in the Total Contract Price or any other compensation. Delays will not be Concurrent to the extent that one Delay affects the Critical Path Schedule and the other Delay does not. In that event, the sole Delay will be the one that affects the Critical Path Schedule. The Change Order extending Contract Time for a Concurrent Delay will be Contractor's sole remedy arising out of the Concurrent Delay.

6-6.3 Payment for Delays to Contractor. *Delete this SSPWC subsection and replace with the following:*

No payment or compensation shall be made to the Contractor for damages because of hindrance or delay from any cause, whether such delays are avoidable or unavoidable. Normal delays to be expected while operating on an active airport shall not be entitled to time extensions. Such normal delays include, but are not limited to, [delays in obtaining AOA access through LAWA Gate #433-B,] [delays in crossing active taxiways,] [other] and [delays due to periodic holding of truck traffic through NAVAID critical areas on the haul road.] Whenever the Engineer orders a temporary suspension of Work due to unsuitable weather conditions, as defined in Section 1-2, the Contractor shall be entitled to a non-compensatory extension of time equal to the duration of the suspension. Unsuitable weather conditions, exclusive of rain days, an average of [ten (10)] percent of the time at [Van Nuys][Los Angeles International] Airport.

6-6.4 Written Notice and Report. *This subsection applies as written in the SSPWC.*

6-7 TIME OF COMPLETION.

6-7.1 General. *Delete this SSPWC subsection and replace with the following:*

The Contractor shall conduct the Work in a manner and with sufficient material, equipment, and labor to insure completion within **[insert # of Days here] (___)** Days, plus any extra time allowed for delays or extra Work, commencing with and including the date stipulated in the Notice to Proceed.

[PE: Specify specific work hour requirements, if any.]

[The Contractor shall work the shifts required to comply with Section 11.] [No more than one 8-hour shift per day shall be worked.] Working hours shall be 7:00 a.m.– 3:00 p.m. unless otherwise approved by the Engineer, and no Work shall be done on Saturdays, Sundays, or legal holidays without the written permission of the Engineer. The acceptance of nighttime deliveries

and specified night Work are the exception to this requirement. No construction activities shall take place the day after Thanksgiving and the day before Christmas.

The acceptance of nighttime deliveries and specified night Work are the exception to this requirement. No construction activities shall take place the day after Thanksgiving and the days before and after Christmas.

The completion of the individual components of Work shall be in accordance with the following Completion Schedule.

[PE: Insert intermediate milestones on the Completion Schedule here - see example below.]

Completion Schedule

Component of Work/Milestones	Start*	Finish
Fire Station No. 51	0	277
Delta Maintenance Building	0	98
Guard Post No. 2	0	217
Completion of Entire Project	0	575
*No. of calendar Days after the Notice to Proceed has been issued by the Engineer		

6-7.2 Working Day. *This subsection applies as written in the SSPWC.*

6-7.3 Contract Time Accounting. *This subsection applies as written in the SSPWC.*

6-8 COMPLETION, ACCEPTANCE, AND WARRANTY *Delete this SSPWC subsection and replace with the following:*

The Engineer and Inspector will inspect the Work for acceptance upon receipt of the Contractor's written assertion that the Work has been completed per the Contract Documents.

If, in the Engineer's or Inspector's judgment, the Work has been completed and is ready for acceptance, the Engineer will so certify in writing by issuance of the "Notice of Final Acceptance." The Contractor is not relieved from the responsibility to protect the Work until such time as the Contractor receives the "Notice of Final Acceptance."

All Work shall be warranted by the Contractor against defective workmanship and materials for the warranty period specified in these Contract Documents or one (1) year after the date of the final acceptance of the Work by LAWA, whichever is longer. Neither the final acceptance nor the final payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty material or quality of Work. The Contractor shall have the faithful performance bond remain in full effect for the warranty period or one (1) year after final acceptance, whichever is longer. The Contractor shall replace or repair any such defective Work in a manner satisfactory to the Engineer, after notice to do so from the Engineer, and within the time specified in the notice. If the Contractor fails to make such replacement or repairs within

the time specified in the notice, the Agency may perform this Work and the Contractor's sureties shall be liable for the cost thereof.

The Work shall be under the charge and care of the Contractor until final acceptance of the Work. The Contractor shall take every precaution against injury or damage to the Work from the action of the elements or any other cause, whether arising from the execution or non-execution of the Work. The Contractor shall rebuild, repair, restore, and make good, at the Contractor's expense, all injuries or damage to the Work occurring before acceptance of the Work.

Any loss or damage as described below shall be sustained by the Contractor:

1) Arising from all unforeseen obstructions or difficulties, either natural or artificial, encountered in the prosecution of the Work.
2) From any action of the elements prior to the final acceptance of the Work.
3) From any act or omission not authorized by these Contract Documents on the part of the Contractor or Subcontractors.

Near or at the completion of the Work, a final inspection will be made by a Project construction team consisting of the Engineer, Inspector, and the Contractor. The Engineer will provide a final Inspection Correction List itemizing all Work necessary to complete the Project per the Contract Documents. Upon determination that the Work has been completed in accordance with the Contract Documents as provided herein, a "Notice of Final Acceptance" will be issued to the Contractor by the Engineer.

The improvements shall be placed in service upon issuance of the "Notice of Final Acceptance," unless otherwise provided in the Notice. The Contractor will then be relieved of its contractual liability for subsequent injury or damage to persons, property, or the Work, and relieved of the duty to maintain and protect the Work. However, in no event shall the Contractor be relieved of its obligation to have performed the Work completely and in strict accordance with the Contract Documents.

After the date of acceptance of the Work by the Executive Director, no additional Claims may be submitted.

On Class "B" permits, the Permittee-Contractor, or its Surety will be held responsible for maintaining and protecting the Work until issuance of a "Certificate of Acceptance" by the City Engineer as provided in Section 62.113 of the Municipal Code. After issuance of the "Notice of Final Acceptance" and after the completed improvements in dedicated areas are placed in service, the Permittee will be relieved of the duty to maintain and protect such completed improvements resulting from public use, action of the elements, or other cause not due to the Permittee's own operations or negligence. Any dangerous or hazardous condition created by a Permittee or its Contractor as found and determined by the Engineer, shall immediately be corrected upon demand by the Agency. Upon failure to correct as required, the Agency may make the correction without further notice to the Permittee-Contractor or its Surety, and all costs

incurred shall be paid by the Permittee-Contractor or its Surety.

6-9 LIQUIDATED DAMAGES. *Delete this SSPWC subsection and replace with the following:*

[PE: Prepare justification for the liquidated damage number.]

Failure of the Contractor to complete the Work within the time allowed will result in damages being sustained by the Agency. For each consecutive day in excess of the time specified for the completion of Work, as adjusted in accordance with Subsection 6-6, the Contractor shall pay to the Agency, or have withheld from monies due it, the sum of [insert $ amount here]_____, unless otherwise provided in the Contract Documents.

Execution of the Contract shall constitute agreement by the Agency and Contractor that [insert $ amount here]_____ per day is the minimum value of the costs and actual damage caused by the failure of the Contractor to complete the Work within the allotted time. Such sum is Liquidated Damages and shall not be construed as a penalty, and may be deducted from payments due the Contractor if such delay occurs.

The Agency expressly denies that any progress payments made after the scheduled completion date constitute a waiver of Liquidated Damages.

The Liquidated Damages shall apply to each Phase or component of Work to be done as well as to the total Contract.

The amount of Liquidated Damages shall be as per the table of Liquidated Damages below:

[PE: Long Form – Use this on large projects (greater than $10 million) or moderate sized projects with a high degree of complexity or interfaces with other projects. Allow Construction Manager to review Section 10 prior to finalizing Specification. Also, determine appropriate Liquidated Damages charge for non-submitted schedules; base your cost on total contract dollar amount. For example, the general guideline for establishing LD's is $150 per million per Day (i.e. A $20M project = $3000/Day of LD's).]

Liquidated Damages

Component of Work	**Amount**
Completion of the entire Project	$10,000/Day
Failure to open Sepulveda Boulevard lanes at the time specified on the Contract Plans after each night of Work	$5,000/hour
Completion of Fire Station No. 51	$1,000/Day
Completion of the Delta Maintenance Building	$1,000/Day

Completion of Guard Post No. 2	$1,000/Day

6-10 USE OF IMPROVEMENT DURING CONSTRUCTION. *To this SSPWC subsection add the following:*

The Agency shall have the right, upon ten (10) Days written notice to the Contractor and the Surety, to take possession of and use any completed or partially completed portion of the Work. Such taking possession and use shall not be deemed an acceptance of any Work. If prior use materially impedes the operations of the Contractor, the Contractor shall be entitled to a reasonable extension of time. The Engineer shall certify as to the amount of delay, which may have been caused by such prior use.

[PE: The alternative language below is for Statement of Partial Acceptance.]

[The Agency shall have the right, upon ten (10) Days written notice to the Contractor and the Surety, to utilize or place into service any item of equipment or other usable portion of the Work prior to completion of the entire Project. Whenever the Agency plans to exercise said right, the Contractor will be notified in writing by the Agency, identifying the specific portion or portions of the Work to be so utilized or otherwise placed into service. Following final inspection by the Inspector and establishment of a Final Inspection Correction List, a Statement of Partial Acceptance will be issued.

It shall be understood by the Contractor that until a Statement of Partial Acceptance is issued, all responsibility for care and maintenance of all items or portions of the Work to be placed in use shall be borne by the Contractor. Upon issuance of a Statement of Partial Acceptance, the Agency will accept responsibility for the protection and maintenance of all such items and portions of the Work described in the written notice, and it is further understood that the manufacturer's warranties of any affected equipment will commence not later than the date for commencement of the warranties indicated on the Statement of Partial Acceptance. However, the Contractor shall retain full responsibility for satisfactory operation of the total Project and the Contractor's guarantee period shall commence only after the final acceptance of the Contract by LAWA. Such guarantee of total systems operation shall include that portion or portions previously placed into beneficial use by the Agency.

The issuance of a Statement of Partial Acceptance for any part of the Work shall not relieve the Contractor of its obligation to promptly remedy any omissions and latent or unnoticed defects in the Work covered by the Statement of Partial Acceptance. The Agency shall have the right to restrict the Contractor's use of occupied portion of the Work but shall allow the Contractor reasonable access to complete or correct items required by the Contract Documents.

The Agency may, if the Work is progressing satisfactorily, release part of the retention on portions of the Work for which a Statement of Partial Acceptance has been issued, provided that all of the following conditions have been met:

1) Partial final inspection corrections have been completed to the satisfaction of the

Inspector.

2) The Contractor submits a written request for release of retention, which includes a verifiable valuation of the identified portions of the Work covered by the Statement of Partial Acceptance.
3) Impacted Subcontractors, major Suppliers and the Contractor's Surety all agree in writing to release of retention.
4) If any minor corrections remain which do not directly affect operations or maintenance then twice the values of the remaining cleanup items shall be retained on each request for release.
5) The Contractor signs a Change Order that specifically states the value of the retention being released.

The Engineer shall issue a no-change-in-Contract cost Change Order reflecting the Work for which a Statement of Partial Acceptance has been issued and the amount of the retention to be released. This Change Order shall authorize reduction of the retention on the next payment.

[PE: Use the paragraph below if the building will be occupied during all phases of construction.]

[The Contractor is hereby made aware that the building shall be continuously occupied during all phases of construction. The Contractor must take any and all measures necessary to maintain cleanliness on both the interior and exterior of all Work areas. The Contractor is responsible for the repair and/or replacement for any damage caused by the Contractor to the premises, the contents therein, or the adjacent areas. The Contractor shall take actions to minimize disruption and disturbances to building occupants and adjacent roadways, structures, and landscaping. The Contractor is to abide by all provisions of these Contract Documents regarding protection of existing structures, safety, and maintenance of ingress and egress to the building. The Contractor shall draw special attention to the additional requirements for Site use, maintenance, and cleanliness throughout the Contract Documents and on the Plans.]

END OF SECTION 6

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR

7-1 CONTRACTOR'S EQUIPMENT AND FACILITIES. *To this SSPWC subsection add the following:*

Storage of equipment and materials left overnight shall be in the area designated by the Engineer. Areas adjacent to the construction may be made available for temporary use by the Contractor without cost whenever such use will not interfere with other purposes. The Contractor shall be liable for any damage caused to such premises or areas.

The Contractor shall restore the Operations and Storage Yard and adjacent areas to their original condition prior to final acceptance of the Project, or at the discretion/option of LAWA, left in place at completion of the Project and Ownership shall thereupon be vested to the City.

Equipment and materials shall be stored off the Site until they are to be used on the Work. Equipment and materials located on the Site, but not being used, shall be left at locations to be designated by the Engineer or Inspector. All equipment that is no longer needed shall be removed immediately from the Site. All other operations of the Contractor shall be confined to the areas authorized or approved by the Engineer.

7-2 LABOR.

7-2.1 General. *To this SSPWC subsection add the following:*

The Contractor's employees shall be restricted to immediate work areas at the Project Site, and shall not go beyond work limits noted on the Plans, except as otherwise directed by the Engineer. Only the Contractor, Contractor's employees, Subcontractors, Building and Safety Inspectors or Agency representatives are allowed access to the Site.

7-2.2 Laws. *To this SSPWC subsection add the following:*

The Director of the California Department of Industrial Relations has determined the general prevailing rate of wages applicable to the Work. The schedule of general prevailing rate of wages is on file in the office of the Engineer. Any worker whose work is not covered by any of the classifications listed in the schedule shall be paid not less than the minimum rate for the classification which most nearly corresponds to the work performed by the worker. Such minimum rate shall be retroactive to the time of initial employment of the worker in such classification. In the event of a dispute on the rates, the matter shall be referred for determination to the Executive Director, whose decision on the matter shall be conclusive with the same effect as if the work performed by the worker had been classified and the minimum rate specified in the schedule.

The Contractor shall comply with the provisions of Section 10.8 and Section 10.13 of the Administrative Code of the City of Los Angeles pertaining to nondiscrimination and affirmative

action in employment. A copy can be obtained from the offices of LAWA, 7301 World Way West, 5th floor, Los Angeles, CA, or from www.lacity.org/lacity102.htm. The Contractor shall also comply with Division 2, Part 7, Chapter 1, Article 3 of the Labor Code, and all other applicable statues, ordinances, and regulations relative to employment, wages, and hours of labor. The Contractor shall forfeit as penalty to the City, Twenty-five Dollars ($25.00) for each worker employed, for each calendar Day or portion thereof such person is paid less than the general prevailing rate of wages by the Contractor or any Subcontractor in violation of Division 2, Part 7, Chapter 1, Article 2 of the Labor Code. If the Contractor or any Subcontractor employs workers in any apprenticeable craft or trade in the performance of the Work, then the Contractor and Subcontractors shall comply with Section 1777.5 of the Labor Code.

7-3 LIABILITY INSURANCE. *Delete this SSPWC subsection and replace with subsections 7-3.1 through 7-3.4 as follows:*

7-3.1 General. The Contractor and the Sureties shall defend, indemnify, and save harmless the City, its Boards, officers, agents, and employees, assigns, and successors in interest, from and against all suits, actions, or claims of any character, name, and description brought:

1) For or on account of any injury or damage received or sustained by any person, persons, or property, by or from the Contractor, the Subcontractors, or their officers, agents or employees; or
2) By or as a consequence of any neglect in safeguarding the Work, or
3) Through the use of unacceptable materials in doing the Work; or
4) By or on account of any act of omission, neglect, or misconduct of the Contractor or Subcontractors, or
5) By or on account of an infringement of trademark or copyright; or
6) From any Claim arising or amount recovered under the Workers' Compensation Law or any other law, ordinance, order, or decree,

And so much of the money due the Contractor may be retained as considered necessary by the City, or in case no money is due, the Sureties shall be held until every such suit, action, or Claim has been settled and satisfactory evidence to that effect furnished to the City.

7-3.2 Insurance Provisions.

The Contractor shall procure at its expense, and keep in effect at all times during the term of this Contract, the following types of insurance:

1) Aviation/Airport Liability.

OR

1) Comprehensive General Liability covering all its operations including, but not limited to:
   a) Premises and Operations.
   b) Contractual (Blanket or Scheduled).
   c) Independent Contractors.
   d) Products/Completed Operations.

e) Broad Form Property Damage.
f) Personal Injury.
g) Explosion, Collapse and Underground Hazard.

2) Comprehensive Automobile Liability covering Owned, Non-Owned and Hired Vehicles, if the Contractor's operations require the use of licensed vehicles on the Airport.
3) Employer's Liability Insurance.

In the event the Contractor fails to furnish the Agency evidence of insurance and maintain the insurance as required, the Agency, upon ten (10) Days prior written notice to comply, may (but shall not be required to) procure such insurance at the expense of the Contractor, and the Contractor agrees to promptly reimburse the Agency for the cost thereof plus fifteen percent (15%) for administrative overhead.

At least ten (10) Days prior to the expiration date of any of the above policies, documentation showing that the insurance coverage has been renewed or extended shall be filed with the Agency. If such coverage is intended to be canceled or reduced, the Contractor shall within fifteen (15) Days of such cancellation or reduction file with the Agency evidence that the required insurance has been reinstated or provided through another insurance company. At no time shall work be allowed without insurance as required by the Contract Documents.

Each of said policies shall cover loss or liability for damages in the amount specified in the Insurance Requirements of the Contract Documents.

Policies and other documents evidencing such coverage as provided in this Subsection shall:

1) Be filed with the Agency prior to the Contractor commencing Work (and the Contractor shall not allow any Subcontractor to commence Work until all insurance required of the Subcontractor has been approved).
2) Contain LAWA Contract number, the applicable policy number, the inclusive dates for same and the insurance carrier's name.
3) Bear an original signature of an authorized representative of said carrier.
4) Provide that such insurance shall not be subject to cancellation, reduction in coverage, or non-renewal except after written notice by certified mail, return receipt requested, to the City Attorney of the City of Los Angeles (City Attorney, P.O Box 92216, Los Angeles, CA 90009-2216) at least thirty (30) Days prior to the effective date thereof.

The Agency also reserves the right to request submittal of specific policies of insurance and complete information about the agent and carrier providing such insurance.

The insurance specified herein shall, either by provisions in the policies or by special endorsements attached thereto:

1) Insure the City against the risks to which it is exposed by reason of the Contractor's operations hereunder, and where applicable except for Workers' Compensation and Employers Liability coverage.

2) Include the City, LAWA and all of its officers, employees and agents, as insureds, as respects operations performed by or on behalf of the named insured.
3) Contain the Severability of Interest Clause and Contractual Endorsement set forth below.
4) Be primary and noncontributing with any other insurance held by the City's LAWA.

The Agency shall have no liability for any premiums charged for such coverage, and the inclusion of the Agency as insureds is not intended to, and shall not, make the Agency a partner or joint venturer with the Contractor in the latter's operations for this Contract. Such policies may provide for reasonable deductibles and/or retentions acceptable to the Executive Director based upon the nature of the Contractor's operations and the type of insurance involved.

The City and the Contractor agree that the insurance policy limits specified in this Section shall be reviewed for adequacy annually through the term of this Contract by the Executive Director, who may thereafter require the Contractor to adjust the amounts of insurance coverage to whatever amount the Executive Director deems to be adequate.

Severability of Interest Clause. Each liability insurance policy shall apply separately to each insured against whom claim is made or suit is brought except with respect to the limits of the company's liability.

Contractual Endorsement. Such insurance as is afforded by each liability insurance policy shall also apply to liability assumed by the insured under written contract with the City of Los Angeles.

NO PAYMENT WILL BE MADE TO THE CONTRACTOR UNLESS THE CONTRACTOR HAS COMPLIED WITH THE ABOVE PROVISIONS.

7-3.3 Diversity of Interest.

If the Contractor shall procure or maintain any insurance upon any property in which the City has or may acquire an interest or upon which it has or may require a lien under this Contract or otherwise, such policies shall, in the following language, formally disclose the diversity of interest:

> "Notice is hereby given and accepted that the City of Los Angeles has or may acquire an interest in the subject matter of this insurance."

Such policy or policies shall also contain a loss payable clause reading as follows:

> "Loss, if any, under this policy shall be adjusted with the named insured and be made payable to the City of Los Angeles."

Any payment thereunder shall insure to the benefit of the City to the extent of any loss suffered by the City and to the Contractor as to any remaining balance.

7-3.4 Attorneys' Fees.

If the City shall, without any fault, be made a party to any litigations commenced by or against the Contractor arising out of the Contractor's operations and as a result of which the Contractor is held liable, in whole or in part, by settlement, adjudication, or otherwise, then the Contractor shall pay all costs and reasonable attorneys' fees incurred by or imposed upon the City in connection with such litigation. In any action by the City or the Contractor for recovery of any sum under the Contract, or the enforcement of any of the terms, covenants or conditions contained herein, the prevailing party shall be entitled to reasonable attorneys' fees in addition to costs, expenses and necessary disbursements incurred in such action. Each party shall give prompt notice to the other of any claim or suit instituted against it that may affect the other party.

7-4 WORKERS' COMPENSATION INSURANCE. *Delete this SSPWC subsection and replace with the following:*

Before execution of the Contract by the Executive Director, the Contractor shall file with the Engineer the following signed certifications:

> "I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the Work on this Contract."

The Contractor shall also comply with Section 3800 of the Labor Code by securing, paying for, and maintaining in full force and effect for the duration of the Contract, complete Workers' Compensation Insurance, and shall furnish a Certificate of Insurance to the Engineer before execution of the Contract. The Agency, its officers, or employees, will not be responsible for any claims in law or equity occasioned by failure of the Contractor to comply with this paragraph.

Each compensation insurance policy shall by endorsement or rider provide that in the event of cancellation, reduction in coverage, or non-renewal for any reason, the City Attorney of the City of Los Angeles shall be notified by certified mail, return receipt requested, not less than thirty (30) Days before the effective date thereof. Notice shall be sent to City Attorney of the City of Los Angeles, P.O Box 92216, Los Angeles, CA 90009-2216.

The required insurance shall cover any assignee of the Contractor performing or causing to be performed any Work or labor in fulfillment of the Contract. The insurance shall be issued by a responsible insurance carrier authorized under the laws of California and satisfactory to the City. No payment will be made to the Contractor unless evidence of Worker's Compensation Insurance is in the possession of the Engineer.

7-5 PERMITS. *Delete this SSPWC subsection and replace with the following:*

[PE: If Contract is unit price, use the paragraph below.]

[The Contractor shall procure all permits, approvals, and licenses required, pay all charges and fees, and give all notices necessary, except that LAWA will procure and pay for the building permit. The Contractor shall procure all required permits, approvals, and licenses thirty (30) Days prior to the commencement of the related Work.]

[PE: If Contract is lump sum, use the paragraph below.]

[The Contractor shall procure all permits, approvals, and licenses required, pay all charges and fees, and give all notices necessary. The Contractor shall procure all required permits, approvals, and licenses thirty (30) Days prior to the commencement of the related Work. The cost of the permits and licenses is incidental to the other Work and no additional payment shall be made for costs incurred in obtaining the permits and licenses or in conforming to the requirements thereof.]

[PE: Insert agency name, type of permit, and contact person with phone number -- see abbreviated example below.]

The Contractor shall procure all permits, approvals, and licenses required, pay all charges and fees, and give all notices necessary. Permits, approvals, and licenses shall be acquired at least thirty (30) Days prior to the commencement of the related Work.

The cost of permits required by outside agencies, including Los Angeles Building and Safety, Los Angeles Department of Public Works, Federal Aviation Administration and the State of California, will be reimbursed under the lump sum pay item 7.1 in this Section. Because the scheduling of inspections related to these permits is in the control of the Contractor, all costs for inspection as required by these agencies for the permitted work shall be borne by the Contractor. These inspection costs will be considered incidental to the related work items and no separate payment will be made. It will be the Contractor's responsibility to ensure that inspections are scheduled in order to conform to time requirements as described elsewhere in these specifications. Inspections not previously approved by the Engineer will be subject to interruption and/or rescheduling as necessary to accommodate active aircraft operations and/or other airport operations or security requirements.

It is assumed that bidders qualified to perform the work are familiar with the requirements to complete such work under the regulation of various agencies for the disciplines involved in the project, and shall include such costs in their bids.

Inspection costs for work not requiring outside agency permitting (earthwork; pavement demolition; pavement construction; storm drain line installation) will be borne by LAWA. The disciplines for which it will be the Contractor's responsibility to provide permits and for which he shall be responsible for inspection costs, include, but are not limited to:

The following list of permit/approval agencies has been contacted and Plans have been submitted

to each for review, approval, and permit issuance:

Agency	Type of Permit/ Number (if appropriate)	Contact Person/Phone No.
Caltrans District 7	Encroachment Permit	Refugio Dominguez (213) 897-5580
City of Los Angeles Dept. of Building & Safety	Building Permit #633338	Raymond Chen (213) 977-6380
City of Los Angeles Fire Department	Approval	Michael Reagan (213) 485-6274
LAX Airport Police	Approval	Gary Green (310) 636-0200

Prior to commencing Work on the Contract, the Contractor and its Subcontractors must supply either the Business Tax Registration Certificate Number, Business Tax exemption Number or the Vendor Number obtained from the City Clerk. The Contractor must also provide the effective dates of the number.

7-6 THE CONTRACTOR'S REPRESENTATIVE. *To this SSPWC subsection add the following:*

The Engineer and the Inspector reserve the right to:

1) Disapprove any candidate named as the Contractor's representative or alternate who fails to meet the provisions set forth herein.
2) Remove, without any right to work on the Project, either the Contractor's representative or alternate, who in the sole opinion of the Engineer or the Inspector, has demonstrated incompetence, lack of ability, or other unsuitability to perform supervision of the Work and that individual shall not, without permission of the Agency, be re-employed on the Project.

If the Contractor's representative or alternate leaves the employ of the Contractor, the Contractor will be required to replace the individual(s) within fifteen (15) Days and to fulfill the requirements of this Subsection.

Failure to have the Contractor's representative or alternate present at the Site of the Work at all times while Work under the Contract is in progress shall constitute suspension of the Work by the Contractor, until such time as said individual(s) are again present at the Site. No payment or extension of time will be allowed for any Work performed in the absence of said representative or alternate.

7-7 COOPERATION AND COLLATERAL WORK. *To this SSPWC subsection add the following*:

Paving of roadway areas shall be withheld until planned utility changes or installations have been made under City permits and until verifications of completion of all such changes or installations have been received by the Engineer. The Contractor is responsible for assuring that verifications are submitted by the utilities. Underground final inspection and acceptance of the sanitary sewer and storm drain installations shall precede paving operations. The Contractor is required to notify affected City offices of Work to be done.

[PE: Add the following table when B-permit is involved.]

TABLE 7-7(A)

Item	Office of LADOT to be notified	Cost to be borne by	Required Notice (working days)
Work on signal - controlled intersection	Traffic Signal Inspector: Central Area: (213) 485-1071 Western Area: (213) 485-6834 Valley Area: (818) 756-7852 ATSAC Project Engineer: (213) 485-2815	Contractor	3
Traffic Signal and Interconnect damage	Signal Superintendent Daytime: (213) 847-2991 After Hours: (213) 485-2046		Immediate
Parking meter damage	Parking Meter Supervisor: (213) 485-2273		
Parking meter removal and replacement	Parking Meter Planning Supervisor: (213) 847- 4230	City**	5
Material and labor by LADOT	Scheduling: Sign/Striping: (213) 485-2185 Signal: (213) 485-2194		
Traffic Sign removal, relocation and replacement	Appropriate District Transportation Engineer*: Central District: (213) 485-2284 East Valley District: (818)756-8441 Hollywood District: (213) 485-4282 West Valley District: (818)756-8784 Western District: (310) 575-8138 Southern District: (310) 548-7651		
Parking restrictions, changes relating to temporary striping			10
Final traffic striping and pavement marking		Contractor	5
Temporary Traffic Control Plan			30
Temporary striping installation mark out			2
Offsite Detour Signs			5
Placement of temporary "No Parking" signs	Special Traffic Control Section: (213) 485-2298		4

* For B-Permit projects, notify citywide investigations, (213)580-5211.
** On B-Permit projects, the costs shall be charged to the permittee as required by section 62.110 of the Los Angeles Municipal Code.

The City may award other contracts and perform Work with its own forces concurrent with the Work of the Project. Said Work may be in areas adjacent to and within the areas of this Project.

The Contractor shall make every effort to cooperate and coordinate the Work with other contractors and City work forces, including location, and access to materials stored on the Site, to expedite completion of this Project. All coordination of the Work is subject to the approval of the Engineer.

[PE: Provide information on known coordination issues. For example:]

[The Contractor shall coordinate with the City of Los Angeles Information Technology Agency (ITA) for the installation of the dispatch/fire phone/PA system in Fire Station 51. The Contractor shall provide all junction boxes and cabinets as indicated on the Plans, and shall furnish all system components to the ITA as set for in these Contract Documents. The ITA will install all components and wiring necessary to complete the dispatch/fire phone/PA system. Contractor shall notify ITA six (6) weeks prior to the expected start date of system installation. The system installation will require six (6) to eight (8) weeks.

No Work that would impact aircraft traffic on Taxilane C shall be performed until the completion of construction on the Southside Taxiways WF, WG, and T Project. Construction on this Project is scheduled to be completed by January 1, 2003.

The Chevron Pipeline Company will extend six (6) pipe casings under the new Taxiway C alignment. This work is shown in Phase I of the Construction Phasing Drawings. The Contractor shall accommodate the work to be done by Chevron and its subcontractors.]

7-8 PROJECT SITE MAINTENANCE.

7-8.1 Cleanup and Dust Control. *Delete the second paragraph of this SSPWC subsection and add the following:*

The Contractor shall be responsible for removing from the Site and other public streets, excavated materials and debris resulting from the Work. Vehicles exiting the Site shall have all dirt clods and mud removed from their tires.

[The Contractor shall furnish and operate a self-loading vacuum sweeper trucks with spray nozzles and at least two (2) water trucks as required to maintain the work area, or as directed by the Engineer. Vehicles exiting the Site shall have all dirt clods and haul routes mud removed from their tires. A minimum of one vacuum sweeper and one water truck must be continuously operating at all times when the Contractor or any subcontractor is working on site.]

The Contractor shall contain dust and remove it from the Site at intervals sufficient to prevent contamination outside work limits and as directed by the Engineer. The Contractor shall use adequate watering techniques to alleviate accumulation of construction-generated dust.

1) The Contractor shall be responsible for containment of dust emission from all construction, transport, storage or handling activities, in accordance with South Coast Air Quality Management District (SCAQMD) Rule 403: Fugitive Dust.
2) The Contractor shall be responsible for clean-up of all construction-related dirt on approach routes to the Site.
3) The Contractor shall furnish trash bins for all debris resulting from Construction. All debris shall be placed in trash bins daily. Forms or false work that are to be reused shall be stacked neatly as they are being removed. Forms and falsework that are not to be reused shall be disposed of immediately upon their removal.

[PE: Delete the next two paragraphs if there is no building as part of the Project.]

[At completion of the Work, the interior and exterior of the building(s), including fixtures, equipment, floors, and hardware shall be thoroughly cleaned, with plaster spots, stains, paint spots, accumulated dust, and dirt removed. Cleaning of the exterior shall include, but not be limited to, roofs, window sills, ledges, horizontal projections, steps, rails, sidewalks, and other surfaces.

In addition to general cleaning, the Contractor shall do the following special cleaning at completion of Work:

1) Remove putty stains from glazing, then wash and polish glazing.
2) Remove marks, stains, fingerprints and other soil or dirt from painted, stained or decorated work.
3) Remove temporary protection and clean and polish floors and waxed surfaces.
4) Clean and polish hardware and plumbing trim; remove stains, dust, dirt, plaster and paint.
5) Remove spots, soil, plaster and paint from tile work, and wash tile.
6) Clean all fixtures and equipment, remove excess lubrication, clean light fixtures and lamps, polish metal surfaces.
7) Vacuum-clean carpeted surfaces.
8) Remove debris from roofs, gutters, downspouts and drainage system.]

When requested by the Engineer, the Contractor shall furnish and operate a self-loading motor sweeper with spray nozzles at least once each Working Day for the purpose of keeping paved areas acceptably clean wherever construction, including restoration, is incomplete.

7-8.2 Air Pollution Control. *This subsection applies as written in the SSPWC.*

7-8.3 Vermin Control. *This subsection applies as written in the SSPWC.*

7-8.4 Sanitation. *To this SSPWC subsection add the following:*

The Contractor is responsible for any sewage spills in accordance with the sewage spill prevention and response requirements as stated in this Subsection:

The Contractor is responsible for preventing and containing any sewage spillage. The Contractor is also responsible for the recovery and legal disposal of any spilled sewage, any fines, penalties, claims, and liability arising from negligently causing a sewage spillage. The Contractor is additionally responsible for the violation of any law, ordinance, code, order, or regulation as a result of the spillage.

The Contractor shall exercise care not to damage existing public and private improvements or interrupt existing services and/or facility operations that may cause a sewage spill. Any reasonably anticipated utility and/or improvement damaged by the Contractor shall be repaired immediately at the Contractor's expense. The Contractor shall take all measures necessary to prevent further damage or service interruption to an impacted utility or service. If the construction operations damage an existing utility or damage or interrupt an existing service which causes a sewage spill, the Contractor shall immediately notify the City's representatives. Before the start of construction the Contractor shall request and obtain from the Engineer an emergency roster of designated City representatives with their respective phone numbers, pager numbers, and cellular phone numbers.

Before the start of construction, the Contractor shall develop and submit to the Engineer for approval a written Spill Response Plan to respond to any construction-related sewage spills. This includes, but is not limited to:

1) Identifying all nearby waterways, channels, catch basins and entrances to underground existing storm drains.
2) Furnishing all necessary materials, supplies, tools, equipment, labor and other services for spill containment and cleanup.
3) Arranging for an emergency response unit that will be immediately dispatched to the Site in the event of a sewage spill. The emergency response unit shall consist of emergency response equipment and personnel trained in its use.
4) Developing and including an emergency notification procedure. The procedure will include an emergency response roster with telephone numbers and arrangements for backup personnel and equipment and an emergency notification roster of the designated City representatives.
5) Designating a primary and secondary representative, including their respective phone numbers, pager numbers, and cellular phone numbers. The Contractor's representatives shall be accessible and available at all times to respond immediately to any construction-related emergencies.

If a sewer bypass is called for in the Contract Documents, or is needed to construct the Project, the Contractor is responsible for continuously monitoring the flow levels downstream and upstream of the construction location. This will allow the Contractor to make the earliest possible determination of a system failure that may result in a sewage backup and spill. The Contractor shall include the means and methods of monitoring the flow in the Spill Response Plan.

In case of a sewage spill, the Contractor shall, without instructions from the City, act immediately to control the spill and take all appropriate steps to contain it in accordance with the

Spill Response Plan. The Contractor shall immediately notify the City representatives of the spill and all actions taken. The Contractor shall, within three (3) Working Days from the occurrence of the spill, submit to the Engineer a written confirmation describing the following information related to the spill:

1) The location on a current "Thomas Brothers Guide Map."
2) The nature and volume of the spill.
3) The date and time of the spill.
4) The duration of the spill.
5) The cause of the spill.
6) The type of remedial and/or clean-up measures taken and the date and time of implementation.
7) The corrective and/or preventive action taken to eliminate the possibility of a recurrence.
8) The water body affected.
9) The results of any necessary monitoring.

The Engineer may institute further corrective actions, as deemed necessary, to fully comply with existing law, ordinance, code, order or regulation. The Contractor shall be responsible for all costs incurred for the corrective actions.

It shall be the Contractor's responsibility to assure that all field forces, including Subcontractors, know and obey all safety and emergency procedures to be maintained and followed at the Site, including those in the Spill Response Plan.

7-8.5 Temporary Light, Power, and Water. *To this SSPWC subsection add the following:*

The Contractor shall obtain a permit to draw water from a public fire hydrant from the Los Angeles Department of Water and Power, Telephone (213) 267-2130, for projects in the City of Los Angeles. If feasible, permission for the use of hydrants located on Airport property may be obtained from the Engineer for hydrants owned and controlled by LAWA. Hydrants will be metered and the cost of water usage will be billed to the Contractor.

The Contractor shall obtain temporary power from the Los Angeles Department of Water and Power, Telephone (213) 367-6000, for projects at Los Angeles International Airport and Telephone (818) 771-4100, for projects at Van Nuys Airport.

7-8.6 Water Pollution Control. *To this SSPWC subsection add the following*:

"Water Pollution" shall mean an alteration of the quality of waters by fuels, oils, and other harmful materials. The alteration shall be to a degree that adversely affects such waters for beneficial uses, or facilities that serve such beneficial uses. "Beneficial Uses" shall include, but not necessarily be limited to, domestic, municipal, agricultural, and industrial supply; power generation; recreation; esthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

Water pollution control Work shall consist of implementing good housekeeping pollution control measures to reduce the discharge of pollutants from construction sites to the maximum extent practicable. For construction sites with less than 0.8 hectares (2 acres) of disturbed soil, the Contractor shall implement the following water pollution control measures:

1) Minimum Water Quality Protection Requirements
   a) Eroded sediments and other pollutants must be retained on Site and may not be transported from the Site via sheet flow, swales, area drains, or natural drainage.
   b) Stockpiles of earth and other construction-related materials must be protected from being transported from the Site by water.
   c) Fuels, oils, solvents, and other toxic substances originating from the Contractor's operations shall not be allowed to enter the ground water or be placed where they will enter a live stream, channel, drain, or other water conveyance facility. Spills may not be washed into the live streams, channels, drains, or other water conveyance facilities.
   d) Excess or waste concrete may not be washed into the public way or any drainage system. Provisions shall be made to retain concrete wastes on-site until it can be appropriately disposed of or recycled.
   e) Trash and construction-related solid wastes must be deposited into a covered receptacle to prevent contamination of rainwater and dispersal by wind.
   f) Sediments and other materials may not be tracked from the Site by vehicle traffic. The construction entrance roadways must be stabilized so as to inhibit sediments from being deposited into the public ways. Accidental depositions must be swept up immediately and may not be washed down by rain or by any other means.
   g) After the completion of the Work, the Site shall be cleared of debris and restored to a condition equal to or better than that existing before construction.
2) Wet Weather Erosion Control Plan (WWECP) -- pursuant to Section 61.02 of the LAMC, whenever it appears that the construction Site will have grading during the rainy season (from October 15 to April 15), the Contractor shall submit a WWECP to the Engineer for approval within thirty (30) Days after the Notice to Proceed or get approval thirty (30) Days prior to the beginning of the rainy season, whichever is longer.

Guidance on preparing the WWECP can be found in the Development Best Management Practices Handbook - Part A, Construction Activities adopted by the Board of Public Works, as authorized by Section 64.72 of the LAMC. This publication can be found on the City of Los Angeles' Stormwater website at http://www.cityofla.org/san/swmd/index.htm or by contacting the Program Manager at 213-847-6350.

When required, the Contractor shall obtain permits for erosion and water pollution control from the appropriate jurisdictional agency before the start of construction. The Contractor shall also

conform to the following provisions with respect to water pollution control when working in live streams:

1) Where working areas encroach on live streams, barriers shall be constructed or other means provided to prevent muddying or polluting of such streams.
2) Removal of materials from beneath a flowing stream shall not be started until adequate means, such as a bypass channel around the removal operations, are provided to carry the stream free from mud or silt.
3) Should the Contractor's operations require transportation of materials across live streams, such operations shall be conducted without muddying the stream. Mechanized equipment shall not be operated in the stream channels of such live streams, except as may be necessary in the opinion of the Engineer. The Engineer will judge such Work to be necessary only if construction cannot be done reasonably using other means or methods.
4) Fresh portland cement or fresh portland cement concrete shall not be allowed to enter the flowing water in streams, channels or drains.
5) Material derived from the Work shall not be deposited in a live stream channel.

The Contractor shall also prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) and also implement Best Management Practices (BMP's) in addition to the other requirement of this Subsection for any construction sites that meet any one of the following conditions:

1) Has between 0.8 hectare (2 acres) and two (2) hectares (5 acres) of disturbed soil.
2) Has less than two (2) hectares (5 acres) of disturbed soil and:
    a) Is located in or adjacent to an environmentally sensitive area (ESA).
    b) Is located in a designated hillside area.
    c) A City Engineer's Estimate of Five Hundred Thousand Dollars ($500,000.00) or more.
    d) A contract completion time of one hundred twenty (120) calendar Days or longer.

A work site that is located in a designated hillside area and has less than 0.8 hectares (2 acres) of disturbed soil and is not in or adjacent to an ESA is exempted from the preparation of a SWPPP, if a grading permit is not required. Guidance on preparing the SWPPP can be found in the Development Best Management Practices Handbook - Part A, Construction Activities.

The SWPPP document for permit Work shall include the following information:

1) The name, location, period of construction, and a brief description of the Work.
2) Contact information for the Contractor, including name, address, and telephone number.
3) Name, location, and description of any environmentally sensitive areas located on or adjoining the Project.
4) A list of major construction materials, waste, and activities.
5) A list of BMP's to be used to control pollutant discharge from major construction materials, waste and activities.
6) A site plan (a copy of the plans may be used) indicating the location of the BMP's

where appropriate.

7) A developer's certification statement that all required and selected BMP's will be effectively implemented.

The SWPPP document for publicly financed Work shall include the following information:

1) A list of BMP's to be used to control pollutant discharge from major construction materials, waste and activities.
2) A site plan (a copy of the plans may be used) indicating the location of the BMP's where appropriate.

When the Contractor is required to get any type of permit from the Los Angeles Department of Building and Safety, the Contractor shall submit the SWPPP document to the Los Angeles Department of Building and Safety for review and approval before obtaining the permit as prescribed in LAMC Section 91.106. If the Contractor does not need any type of permit from the Los Angeles Department of Building and Safety, the Contractor shall submit the SWPPP document to the Engineer for review and approval. At least one copy of the approved SWPPP shall be kept at the construction Site and accessible to the Engineer.

For any project that involves grading or disturbing two (2) hectares (5 acres) or more of surface drainage area, LAWA or the Permittee will apply for coverage under the General Construction Activity Stormwater Permit (GCASP) by filing a Notice of Intent (NOI) with the State Water Resources Control Board. The address is State Water Resources Control Board, Division of Water Quality, Attention Storm Water Permit Unit, P.O. Box 1977, Sacramento, CA 95812-1977. The Contractor shall comply with all of the requirements of the GCASP, including the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP).

Whenever the Contractor is required to get any type of permit from the Department of Building and Safety, the Contractor shall show a Waste Discharge Identification Number (WDID) to the Los Angeles Department of Building and Safety as proof of submittal of the NOI.

Such features as drainage gutters, slope protection blankets, and retention basins shall be constructed concurrently with other Work and at the earliest practical time. The Contractor shall exercise care to preserve vegetation beyond the limits of construction.

Should the Contractor violate any of the provisions of this Subsection, or if pollution occurs in the work area for any reason, the Contractor shall immediately notify the Engineer. In addition the Contractor shall, within 10 Days, submit written confirmation to the Engineer describing the incident and corrective actions taken. If pollution, for whatever reason, is detected by the Inspector/Engineer before notification by the Contractor, the required written confirmation shall also include any explanation of why the Contractor had not notified the Engineer.

The City may make any further corrective actions, as deemed necessary, for abatement of water pollution if the Contractor has violated any of the provisions of this Subsection. The Contractor shall be responsible for all costs incurred for the corrective actions.

Failure to comply with the requirements of this Subsection may result in the suspension of Work per Subsection 6-3.

Compliance with the requirements of this Subsection shall in no way relieve the Contractor from its responsibility to comply with other provisions of the Contract, in particular its responsibility for repair of damage and for preservation of property.

Costs for Work required to comply with the requirements of this Subsection shall be paid under Section 27 of these Specifications - Temporary Air and Water Pollution, Soil Erosion, and Siltation Control (FAA – 156).

7-8.7 Drainage Control. *To this SSPWC subsection add the following:*

The Contractor shall ensure that storm and drainage water does not pond due to the temporary blockage of exiting drainage facilities. To this end, the Contractor shall provide temporary methods that allow for the passage of storm and drainage water in a manner equivalent to the existing drainage system.

7-8.8. Graffiti and Vandalism Control. *To the SSPWC add subsection 7-8.8 as follows*:

Throughout all phases of Work, including suspension of Work, and until final acceptance, the Contractor, at its sole expense, shall keep all equipment, field offices, storage facilities and other facilities at the Site free of graffiti and vandalism. Graffiti shall be painted over, masked or cleaned off within twenty-four (24) hours after notification by the Engineer or Inspector.

7-8.9 Daily Reports.

The Contractor and each Subcontractor, whose subcontract is greater than one-half of one percent of the Contract value, shall provide the Engineer with a written Daily Report on a daily basis of all Project activities for each day of the contract. Daily written reports are required for each foreman and each project superintendent from each company, and these reports must be submitted within 24 hours after the end of the work shift. This report is in addition to any required report for Force Account or other form of Time and Materials work. The Daily Report shall include the items specified below for each shift associated with the project. Many of the items can be included in a checklist or fill-in-the –blank type form. The primary purpose of the report is to have an accurate, detailed daily report of the day's activities. Each day's entry shall include:

1) Conditions – Weather: temperature, moisture, wind, site conditions, etc.
2) Personnel – Number of workers by type and trades by employer, list of subconsultants and number of hours worked by QC inspectors.
3) Equipment – Number by type. Hours used.
4) Activities – Specific description and location of work accomplished each day of the work.
5) Quantities – Approximate installations.

6) Materials – a list of all materials received for that day and whether checked and acceptable and where stored.
7) Visitors – List of all visitors to job site.
8) Dated and signed – Diary should also contain the number of days used in the contract.

7-9 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS. *Delete paragraphs 3 and 5 in this SSPWC subsection and add the following:*

The Contractor shall conduct the operations in a manner that avoids injury or damage to adjacent property and improvements. Buildings, trees, shrubbery, lawns, pole lines, fences, guard rails, guide posts, culvert and Project markers, signs, structures, and other objects on or adjacent to the Site, that are not designated for removal, shall be protected from injury or damage. If damaged or removed due to Contractor's operations, they shall be restored or replaced in as nearly the original condition and location as is reasonably possible. Lawns shall be reseeded and covered with suitable mulch. When ordered by the Engineer, the Contractor shall provide and install suitable safeguards to protect any object from injury or damage.

The Contractor shall protect existing pavement and pavement edges against damage or marking from equipment with steel tracks and from equipment loaded in excess of the strength of the pavement or pavement edge. Areas and routes used by the Contractor or Subcontractors shall be restored to their original condition by the Contractor before final acceptance of the Work. The Contractor shall protect all existing underground utilities against damage from equipment and equipment loads.

The fact that any improvement or facility is not shown on the plans shall not relieve the Contractor of the responsibility to ascertain the existence of any structure that may be subject to damage by its operations. The Contractor shall pay for and satisfactorily repair damage to any object which may be damaged as a result of the operations or negligence of the Contractor or Subcontractors. If it becomes necessary for the Agency to repair such damage, the Contractor shall be billed for and shall pay the actual cost to the Agency for labor and materials plus fifteen percent (15%) administrative costs.

The Contractor shall protect and maintain all existing traffic warning, regulatory and guide signs, street name signs (both of the intersection and advanced types) and signal equipment including those temporary control devices that may be required by the Work. The Contractor shall notify the appropriate District Transportation Engineer of any signs maintained by LADOT that will interfere with the completion of its Work that cannot be properly protected. The LADOT will remove, relocate, or reinstall signs at the appropriate times at no expense to the Contractor except for Class "B" permits, in which case the Permittee shall bear said expenses as required by Section 62.110 of the Los Angeles Municipal Code. The Contractor shall bear the cost of installation by the Department of all signs in place at the start of construction that are necessary to the traffic operation of the completed improvements that are found to be missing or damaged upon completion of the Work.

The Contractor shall protect and maintain all existing parking meters and post mounted signs. The Contractor shall notify Parking Meter Planning and Administration at (213) 847-4230 or the Parking Meter Maintenance Shop at (213) 485-2273 of any parking meters or post mounted signs maintained by LADOT that will interfere with the completion of its Work that cannot be properly protected. The LADOT will remove or reinstall parking meters and post mounted signs at the appropriate times at no expense to the Contractor Contractor except for Class "B" permits, in which case the Permittee shall bear said expenses as required by Section 62.110 of the Los Angeles Municipal Code. The Contractor shall bear the costs for any parking meters and post mounted signs that are missing or damaged upon the completion of the Work.

The Contractor shall protect all existing traffic signal equipment, and interconnect systems, including any existing Automated Traffic Surveillance and Control (ATSAC) system. This may be achieved by installing temporary facilities, which may include overhead spans of fiber optic, communication cables and signal conductors, and any equipment necessary to maintain such facilities. The temporary facilities are expressly to maintain normal traffic and interconnect operations. If temporary facilities are installed, the Contractor shall maintain the facilities until the complete restoration of the permanent traffic signal and interconnect system. At no time during the construction period is the traffic signal system to be "off-line" from the ATSAC system. All Temporary and Restoration Traffic Signal Plans shall be designed by a Civil Engineer registered in the State of California. These plans are also subject to approval by LADOT prior to their implementation.

The Contractor shall maintain all existing traffic signal loop detectors. In case of damage to loop detectors, the ATSAC Project Engineer shall be notified, and repairs made within 24 hours. If the Contractor fails to make repairs, any Work done by City forces to restore the operation of damaged loop detectors will be at the Contractor's expense.

All costs to the Contractor for protecting, removing, and restoring existing improvements shall be included in the Bid.

7-10 PUBLIC CONVENIENCE AND SAFETY.

7-10.1 Traffic and Access. *To this SSPWC subsection add the following:*

The Contractor shall conduct all operations in a manner that will cause no interference with airplane traffic or normal operation of the Airport. In all operations the Contractor shall be governed by the regulations and rules of LAWA, comply with FAA AC No. 150/5370-2C, Operational Safety on Airports During Construction, and shall cooperate fully with the Engineer and Airport Manager. All temporary blockages for the movement of construction materials or equipment shall be coordinated with and approved by the Engineer at least forty-eight (48) working hours in advance of any closure.

Within ten (10) Days after the date of the Notice to Proceed and before moving vehicles onto the Site, the Contractor shall submit to the Engineer the proposed Plan for vehicular and pedestrian traffic circulation, including the location and types of signs to be used. Thereafter, and not later

than fifteen (15) Days prior to subsequent changes required by the Engineer for said circulation, sign locations and types, the Contractor shall submit revised Plans to the Engineer.

The Contractor shall provide and install steel plates to bridge any excavation in the public right-of-way. Such bridging shall be in accordance with the provisions of the latest edition of the Work Area Traffic Control Handbook (WATCH), and in addition, shall have a nonskid surface static coefficient of friction of 0.35 per California Test 342 for all steel plates within the traveled roadway of streets and alleys. When required by the Engineer, the Contractor or Permittee shall certify in writing to the Engineer that steel plates to be used in the Work meet the required static coefficient of friction. Also when required by the Engineer, the Contractor or Permittee shall have steel plates to be used in the Work tested in accordance with the above standards for the verification of required static coefficients of friction. Testing shall be done by an independent laboratory approved by the Engineer. The Contractor or Permittee shall pay for any costs associated with the testing of steel plates.

7-10.2 Storage of Equipment and Materials. *This subsection applies as written in the SSPWC.*

7-10.3 Street Closures, Detours, Barricades. *To this SSPWC subsection add the following*:

Every excavation or hazard on or adjacent to runways, taxiways, ramps, other areas on the airfield, or areas accessible by the public shall be marked as indicated below, except as otherwise specified on the plans and in Section 62 of these Specifications:

[PE: Delete language that is not applicable.]

1) **Taxiways.**
   a) Two foot high, weighted delineators, and
   b) Eighteen inch high, weighted flashing red lights, or standing red lights connected to the taxiway lighting system (as approved by the Engineer).

2) **Ramps and Other Aircraft Movement Areas.**
   a) Two foot high, weighted delineators, and
   b) Eighteen inch high, flashing red lights, or standing red lights (as approved by the Engineer).

3) **Other Airfield Areas That Can Be Traversed By Vehicular Traffic.**
   a) Standard wooden barricades, or two to four foot high, weighted delineators, and
   b) Flashing amber lights.
   c) Flaggers

4) **Terminals and other Enclosed Public Areas.**
   The Contractor shall provide a Barricade Plan to LAWA for review and approval. Barricades shall be a minimum of eight (8) feet high constructed of plywood, and

painted off-white. Visqueen shall be placed between the plywood barricade and the ceiling to seal off the construction area from the public area.

Lights shall be portable electrical lamps such as "Neo-Flasher" or "Thoro-Flasher." No lantern or open-flame device shall be used. The Contractor shall obtain the approval of the Engineer of the condition of the Work, including lights, before leaving the Work in the evening.

There shall be no closure of streets and/or the AOA without the express written permission of the Engineer.

Every excavation or hazard on or adjacent to the airfield or other areas shall be marked as specified herein. No lantern or open-flame devices shall be used. See the plans for placement of barricades, lights, and work area perimeter flags. The Contractor shall obtain the approval of the Engineer of the condition of the Work, including lights, before leaving the Work in the evening.

Barricade lights as shown on the drawings shall be placed across taxiway and closed infield areas at the locations and spacing directed by the Engineer. Barricade lights will be paid under Section 62 of the Specifications and, unless otherwise specified, will become the property of LAWA at the conclusion of the Project.

Prior to shutting down barricade lights at the end of work shifts, the Contractor must get the approval of the Engineer.

Nightly or other limited-time runway and/or taxiway closures will require the placement of lighted “X” runway closure markers as described and paid in Section 62 of the specifications.

Taxiway closure markings shall be placed as shown on the Plans, or as directed by the Engineer and as described and paid in Section 62 of the specifications.

Various unlighted reflective signs, for both temporary taxiway and service road traffic, shall be installed as shown on the Plans, and as described and paid in Section 62 of the specifications.

No closures of non-airfield areas or public streets are anticipated for this project.

The Contractor shall provide flaggers at locations necessary to assure safe operation of the Contractor’s vehicles. All costs involved shall be included in the Bid under Specification Section 17.

7-10.4 Safety.

7-10.4.1 Safety Orders. *To this SSPWC subsection add the following*:

The Contractor shall completely fence all excavations, to the satisfaction of the Engineer, to provide protection against anyone falling into the excavation and to the satisfaction of the Engineer. The fencing shall be in place at all times except when workers are present and actual

construction operations are in progress.

The fencing material shall be chain link fabric or welded wire fabric (6x6-W9xW9 minimum) and 5 ft. high, constructed in accordance with one of the following:

1) Tensioned fencing material and have top and bottom tension wires securely fastened to driven steel posts or other equally rigid elements at a maximum spacing of 12 ft.; or
2) Untensioned fencing material securely fastened to extended trench shoring elements at a maximum spacing of 8 ft. and fastened to continuous top and bottom rails constructed of nominal 2 in. x 4 in. lumber or equally rigid material. Framed panels with suitable supporting elements fastened together to form a continuous fence may also be used. AOA fencing shall not have top rails.

The Contractor shall provide the Engineer with a Competent Person trench/excavation certification form for Projects that require shoring and deep excavation. It shall be filled out prior to any worker access to trench or excavation. The Contractor shall certify by this form the name of the Competent Person administering the Work, the soil classification, and the type of excavation protective system provided and/or installed.

[PE: If required, include following language:]

[The Contractor shall file FAA Form 7460-1, Notice of Proposed Construction or Alteration.. Approval shall be obtained from the Federal Aviation Administration for the use of any equipment exceeding fifteen (15) feet in height. The Contractor shall file FAA Form 7460-1, Notice of Proposed Construction or Alteration. A copy of the Form 7460-1 and filing instructions are included in Appendix [ ].]

7-10.4.2 Use of Explosives. *Delete this SSPWC subsection and replace with the following*:

Use of explosives is prohibited.

7-10.4.3 Special Hazardous Substances and Processes. *This subsection applies as written in the SSPWC.*

7-10.4.4 Confined Spaces. *This subsection applies as written in the SSPWC.*

7-10.4.5 Agency Worker Protection. *To the SSPWC add subsection 7-10.4.5 as follows:*

The Contractor shall provide safety equipment, material, and assistance to Agency personnel to properly inspect all phases of the Work, including final inspection. Such equipment, material and assistance shall include, but not be limited to, testing for the presence of explosive or toxic gases and oxygen deficiency in confined spaces, blowers, ventilators, first-aid supplies and equipment, ladders, scaffolds, shoring, harnesses, self-contained breathing apparatus, and

personnel for standby assistance as required. Personal equipment and clothing, such as hard hats, safety glasses, traffic vests and earplugs are not subject to these provisions. When asbestos is being removed, the requirements of the CCR, Title 8, Div. 1, Chapter 4, Subchapter 4, "Construction Safety Orders," and Subchapter 7, "General Industry Safety Orders," shall be implemented.

In all cases involving exposure of Agency personnel to toxic/hazardous materials and/or elements, the City of Los Angeles Personnel Department, Occupational Safety Office, shall have field review authority over the Contractor's operations.

7-10.5 Operation of Vehicles. *To the SSPWC add subsection 7-10.5 as follows:*

The Contractor shall contact the Airport Police, Security Technology Section, Telephone (310) 646-0508, or (818) 909-3523 for Van Nuys regarding specific requirements for the operation of vehicles on airport property and for LAWA drivers' licenses and photo I.D. badges. No passenger cars will be permitted in the restricted area of the Airport. Employees' personal vehicles shall be parked in public lots or off the Airport. Employees shall be transported from there to the Site in vehicles provided and supervised by the Contractor. The Contractor shall follow LAWA badging and driving instructions per Appendix [ ].

Each vehicle or unit of equipment that travels or operates on any part of the AOA shall have an approved decal or painted company name applied to both sides of the vehicles in a location opposite the driver's seat. The identification should be applied to the front door panels. Magnetic or temporary signs are not acceptable. The name of the company should be spelled out in letters no less than three (3) inches high. Use of logos or symbols in lieu of letters is subject to approval by the Airport Operations Manager.

[PE: Include if necessary:]

[Each vehicle or piece of equipment anywhere on the Airport that extends higher than fifteen (15) feet above ground shall be equipped with a checkered flag mounted firmly on the highest part of the vehicle, and shall be obstruction lighted per FAA Advisory Circular 70/7460-1K, Obstruction Marking and Lighting, when the visibility is less than three (3) miles. This flag shall be not less than three (3) feet square consisting of five (5) 1-foot squares of international orange color and four (4) 1-foot squares of white color.]

Delivery vehicles, materials trucks, and heavy equipment shall enter and depart through a point designated by the Engineer. Except as otherwise directed or approved by the Engineer, vehicles in use on the Airport shall be confined to the construction area work Site. Only operators with current restricted area driving passes issued by the LAWA Airport Police, Security Technology Section, will be permitted to operate vehicles in the AOA. When an operator does not have a current pass, a LAWA authorized driver must escort the operator.

The maximum vehicular speed allowed at various locations will be established by the Airport Operations Manager. Vehicles shall be under safe control at all times, weather and traffic

conditions being considered. No vehicle shall at any time be permitted to interfere with or endanger aircraft traffic.

7-10.6 Airport Security Fence. *To the SSPWC add subsection 7-10.6 as follows:*

Any airport security fencing to be relocated or installed is important to the security of the Airport. The Contractor shall schedule the Work to insure the security at all times. Any temporary openings in the airport security fence to facilitate access, relocation, and/or replacement shall be assigned a full-time security guard(s) at the Contractor's expense. Unless otherwise specified, the cost for security guards shall be considered incidental; therefore, no separate payment will be made.

7-11 PATENT FEES OR ROYALTIES. *This subsection applies as written in the SSPWC.*

7-12 ADVERTISING. *Delete this SSPWC subsection and replace with the following:*

No sign will be permitted for advertising the name of the Contractor or any Subcontractor. One neat sign with black lettering on a white background may be used to designate the Contractor's shipping and receiving area for this Project. The face of the sign shall not exceed six (6) square feet. This sign shall be subject to approval by the Engineer.

7-13 LAWS TO BE OBSERVED. *This subsection applies as written in the SSPWC.*

7-14 ANTITRUST CLAIMS. *This subsection applies as written in the SSPWC.*

7-15 AUDITS AND RECORDS. *To the SSPWC add subsection 7-15 as follows:*

The Contractor shall maintain all data and records pertinent to the Work performed under the Contract, in accordance with generally accepted accounting principles. The Contractor shall also preserve and make available all data and records until the expiration of four (4) years from the date of final payment under the Contract. The authorized representative of the Agency shall have access to all such data and records for such time periods to inspect, audit, and make copies thereof during normal business hours. The Contractor shall covenant and agree that it shall require any Subcontractor used in the performance of the Contract to permit the authorized representatives of the Agency to similarly inspect and audit all data and records of said Subcontractor relating to the performance of said Subcontractors under contract for the same period.

7-16 REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS. *To the SSPWC add subsection 7-16 as follows:*

All structures or obstructions which are not to remain in place or to be used in the new construction shall be removed as directed by the Engineer. All material found on the Site or removed and not salvaged shall become the property of the Contractor unless otherwise

indicated. The Contractor must deliver to the Engineer a receipt evidencing that material removed from the Airport for disposal has been disposed of at a legally authorized dumping site.

All disposal costs shall be considered incidental and will not be paid for separately but will be included in the Bid prices for removals.

7-17 SOUND CONTROL. *To the SSPWC add subsection 7-17 as follows:*

The Contractor shall comply with local sound control and noise level rules, regulations and ordinances which apply to Work performed pursuant to the Contract.

Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the Project without said muffler.

END OF SECTION 7

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SECTION 8 - FACILITIES FOR AGENCY PERSONNEL

8-1 GENERAL. *To this SSPWC subsection add the following:*

[PE: Use the following sentence if no field office is required and delete all other language below.]

[The Contractor need not provide a field office at the Site, either for its own use or for the use of Agency Inspectors, Surveyors or Construction Manager.]

The Contractor shall provide a Construction Site Field Office in accordance with Subsection 8-2.

The Contractor shall enclose the Site, staging site, and Construction Site Field Offices with fencing as shown on sheet [ ] of the plans.

Trash receptacles shall be emptied daily.

8-2 FIELD OFFICE FACILITIES.

[PE: Before finalizing these Specifications, consult with Inspection, the Construction Manager, and General Services regarding the office space needed based on duration/size of the Project.]

8-2.1 Class "A" Field Office. *This subsection applies as written in the SSPWC.*

8-2.2 Class "B" Field Office. *This subsection applies as written in the SSPWC.*

8-2.3 Class "C" Field Office. *This subsection applies as written in the SSPWC.*

8-2.4 Construction Site Field Offices *To the SSPWC add subsection 8-2.4 as follows*:

[PE: Select one of the following highlighted paragraphs. This language corresponds to the tables itemizing the required furniture, services and equipment for the offices.]

[The Contractor shall provide two (2) separate Construction Site Field Offices in the Contractor's Operations and Storage Yard; one for its own use and one for the use of the Agency's Inspectors, Surveyors and Construction Manager.]

[The Contractor shall provide three separate Construction Site Field Offices in the Contractor's Operations and Storage Yard; one for the Contractor's own use, one for the use of the Agency's Inspectors/Surveyors and one for the use of the Construction Manager.

[The Contractor shall provide four separate Construction Site Field Offices in the Contractor's Operations and Storage Yard; one for the Contractor's own use, one for the use of the Agency's Inspectors/Surveyors, one for the use of the Construction Manager. and one for City Standard

personnel.]

The Contractor will have to provide his own site office for the entire duration of the project. The Contractor may be required to site the Construction Site Field Offices at a different location from that shown on the plans for the Contractor's Storage Yard.

The Construction Site Field Offices shall be located in the Contractor's Operations and Storage Yard. The Contractor's Operations and Storage Yard area shall be fenced by the Contractor. The fencing shall be chain link fencing of design and type needed to prevent entry onto the Site or any exterior Work area by the public. The Construction Site Field Offices, including all furnishings, equipment, utilities, and fencing shall be installed by the Contractor within fifteen (15) Days of the Notice to Proceed and shall be maintained by the Contractor through the duration of the Project at no additional expense to the Agency. The Contractor's Operations and Storage Yard and access thereto shall be kept neat and orderly throughout construction and all deficiencies in the maintenance of this area shall be promptly corrected by the Contractor. The Contractor's Operations and Storage Yard shall be restored to a condition equal to the condition prior to the start of construction and equal to the condition of areas adjacent to the Site and as approved by the Engineer. Stock piling of earth and pavement material will not be permitted. Stock piling of all other material shall be at the discretion of the Engineer.

The Construction Site Field Office(s) shall have a minimum of two (2) doors and a window area of not less than forty-eight (48) square feet. Windows shall be provided with security bars. All doors and windows shall be provided with screens and secure locks. Provide mini-blinds for all windows.

Electric power shall be provided to include a minimum of four (4) 100-volt a/c duplex electric convenience outlets. At least one such outlet shall be located on each wall. The electrical distribution panel shall provide not less than two (2) circuits providing 110-volt, 60-Hertz service.

[Contractor shall obtain power and telephone services from utility.] [Water and sewer connections to the main shall also be provided by the Contractor, or portable water and sewer tanks shall be provided and maintained by Contractor.]

Lighting shall be provided for office to provide illumination at the tables and desk at a level of 100-foot candles. An outdoor lighting fixture with three hundred (300) watts shall be provided at each door.

Heating and air conditioning of sufficient capacity shall be provided at no expense to the Agency to adequately control the temperature at all times.

The Contractor shall provide integral sanitary facilities within offices(s) for the sole use of office personnel. Sanitary facilities shall include a water closet and wash basin with hot and cold potable running water. Each restroom shall be provided with liquid soap and dispensers, toilet

paper and dispenser, toilet seat covers and dispenser, paper towels and dispenser, waste baskets, industrial first aid kits with eyewashers, and continuous on-going supply of all disposable goods.

Extended area, non-coin-operated telephone service shall be provided within the office area. The installation shall include sufficient extension cord to serve the plan table and desk. Telephone system shall include voice mail accessible from outside phone line and shall accommodate keying in sufficient number of digits to allow access to outside voice mail by name or by number. Submit system specifications for LAWA approval. Include connection fees, usage fees, and full maintenance.

Construction Site Field Office(s) for LAWA and City of Los Angeles Standards personnel shall be equipped with the furniture, services and equipment listed in the table below. All furniture, services and equipment will be maintained by the Contractor for the period of time described above.

[PE: Use this language and table below if two (2) field offices are required (no separate Consultant Construction Manager Office is required). Verify inclusion of radios, DSL, cell phones, PC's and laptops with Civil Engineer and ITD.]

The Construction Site Field Office for use by Agency Inspectors, Surveyors and Construction Manager shall be equipped in accordance with the table below:

Furniture, Services and Equipment	**Agency Inspectors, Survey and Construction Manager Total Quantity**
Minimum square feet of floor area	400
Full height partitioned office with lockable door as well as a lockable door connecting directly to the exterior. (120 SF minimum)	2
Telephone with Dedicated Telephone Lines	3
Dedicated Fax Line	1
Digital Subscriber Lines (DSL)	3
New Printer-Fax-Scanner-Copier machine (plain paper) with stand, model as specified by the Engineer, the cost of which shall not exceed $XXXX. The Contractor shall pay for all costs including supplies, activation and service fees for duration of the Project	1
New Self-loading copier with automatic recirculating document feeder and sorter as specified by the Engineer, double side copy and collating capabilities, the cost of which shall not exceed $XXXX. The Contractor shall pay for all costs including supplies, activation and service fees for duration of the Project	1
Additional telephones	2

Furniture, Services and Equipment	Agency Inspectors, Survey and Construction Manager Total Quantity
New Metal double-pedestal desk, 30"x66" with drawers suitable for holding files and with locks	3
New Metal double-pedestal desk, 36"x72" with secretarial and with drawers suitable for holding files and with locks	
Plan table – 5'x8'	2
Adjustable metal office chairs, Steelcase or approved Equal	6
Metal plan table chairs	2
Lockable, four-drawer file cabinets (legal size)	2
3-shelf bookcases	2
Metal plan rack, 12 sticks	2
In/Out Mailboxes	6
Lockable metal supply cabinet	1
Refrigerator, minimum 18 cubic feet	1
Microwave, minimum 2.0 cubic feet	1
Bulletin board and marker board, 4' x 8'	2
Wastebasket	4
Refrigerated bottled water dispenser unit, with hot and cold water dispenser and paper cup supply	1
Cellular phone including service providers and batteries, Nextel Model 1000. Minimum 500 air time weekday minutes per month	?
Conference room with table & chairs to accommodate ___ number of persons	1

[PE: Use this language and table below if three field offices are required.]

The Construction Site Field Offices for use by the Agency's Inspectors/Surveyors and the Construction Manager shall be equipped in accordance with the table below:

Furniture, Services and Equipment	Agency Inspectors and Survey Total Quantity	Construction Manager Total Quantity
Minimum square feet of floor area	400	400
Full height partitioned office with lockable door as well as a lockable door connecting directly to the	1	1

Furniture, Services and Equipment	Agency Inspectors and Survey Total Quantity	Construction Manager Total Quantity
exterior. (120 SF minimum)		
Telephone with Dedicated Telephone Lines	2	2
Dedicated Fax Line	1	1
Digital Subscriber Lines (DSL)	2	2
New Printer-Fax-Scanner-Copier machine (plain paper) with stand, model as specified by the Engineer, the cost of which shall not exceed $XXXX. The Contractor shall pay for all costs including supplies, activation and service fees for duration of the Project	1	1
New Self-loading copier with automatic recirculating document feeder and sorter as specified by the Engineer, with double side copy and collating capabilities the cost of which shall not exceed $XXXX. The Contractor shall pay for all costs including supplies, activation and service fees for duration of the Project	1	1
Additional telephones	2	2
New Metal double-pedestal desk, 30"x66" with drawers suitable for holding files and with locks	2	2
New Metal double-pedestal desk, 36"x72" with secretarial and with drawers suitable for holding files and with locks		1
Plan table – 5'x 8'	2	1
Adjustable metal office chairs, Steelcase or approved Equal	2	5
Metal plan table chairs	2	1
Lockable, four-drawer file cabinets (legal size)	1	1
3-shelf bookcases	1	1
Metal plan rack, 12 sticks	1	1
In/Out Mailboxes	6	6
Lockable metal supply cabinet	1	1
Refrigerator, minimum 18 cubic feet	1	
Microwave, minimum 2.0 cubic feet	1	
Bulletin board and marker board, 4' x 8'	1	
Wastebasket	4	4
Refrigerated bottled water dispenser unit, with hot and cold water dispenser and paper cup supply	1	
Cellular phone including service providers and batteries, Nextel Model 1000. Minimum 500 air time	?	?

Furniture, Services and Equipment	Agency Inspectors and Survey Total Quantity	Construction Manager Total Quantity
weekday minutes per month		
Conference room with table & chairs to accommodate ___ number of persons	0	1

[PE: Use this language and table below if four field offices are required.]

The Construction Site Field Offices for use by the Agency's Inspectors/Surveyors, the Construction Manager, and City Standard personnel shall be equipped in accordance with the table below:

Furniture, Services and Equipment	Agency Inspectors and Survey Total Quantity	Construction Manager Total Quantity	City Standard Personnel Total Quantity
Minimum square feet of floor area	400	400	400
Full height partitioned office with lockable door as well as a lockable door connecting directly to the exterior. (120 SF minimum)	1	1	0
Telephone with Dedicated Telephone Lines	2	2	1
Dedicated Fax Line	1	1	0
Digital Subscriber Lines (DSL)	2	2	0
New Printer-Fax-Scanner-Copier machine (plain paper) with stand, model as specified by the Engineer, the cost of which shall not exceed $XXXX. The Contractor shall pay for all costs including supplies, activation and service fees for duration of the Project	1	1	0
New Self-loading copier with automatic recirculating document feeder and sorter as specified by the Engineer, with double side copy and collating capabilities the cost of which shall not exceed $XXXX. The Contractor shall pay for all costs including supplies, activation and service fees for duration of the Project	1	1	0
Additional telephones	2	2	0
New Metal double-pedestal desk, 30"x66" with drawers suitable for holding files and with locks	2	2	2

Furniture, Services and Equipment	Agency Inspectors and Survey Total Quantity	Construction Manager Total Quantity	City Standard Personnel Total Quantity
New Metal double-pedestal desk, 36"x72" with secretarial and with drawers suitable for holding files and with locks		1	0
Plan table – 5'x 8'	2	1	0
Adjustable metal office chairs, Steelcase or approved Equal	2	5	4
3' x 6' work table adjacent to trailer	0	0	1
3' x 8' table	0	0	1
4'x6'x6" concrete slab adjacent to trailer	0	0	1
Metal plan table chairs	2	1	0
Lockable, four-drawer file cabinets (legal size)	1	1	0
3-shelf bookcases	1	1	0
Metal plan rack, 12 sticks	1	1	0
In/Out Mailboxes	6	6	0
Lockable metal supply cabinet	1	1	1
Refrigerator, minimum 18 cubic feet	1	?	0
Microwave, minimum 2.0 cubic feet	1	?	0
Bulletin board and marker board, 4' x 8'	1		0
Wastebasket	4	4	1
Refrigerated bottled water dispenser unit, with hot and cold water dispenser and paper cup supply	1		0
Cellular phone including service providers and batteries, Nextel Model 1000. Minimum 500 air time weekday minutes per month	?	?	?
Conference room with table & chairs to accommodate ___ number of persons	0	1	0

[PE: If no field laboratory is required, use the choice below:]

8-3 FIELD LABORATORIES. *Delete this SSPWC subsection and replace with the following*:

The Contractor need not provide a field laboratory.

[PE: If a field laboratory is required, use the choice below.]

8-3 FIELD LABORATORIES. *This subsection applies as written in the SSPWC.*

[PE: If no bathhouse facility is required, use the choice below.]
8-4 BATHHOUSE FACILITIES. *Delete this SSPWC subsection and replace with the following*

The Contractor need not provide a bathhouse facility at the Site.

[PE: If a bathhouse facility is required, use the choice below.]
8-4 BATHHOUSE FACILITIES. *This subsection applies as written in the SSPWC.*

8-5 REMOVAL OF FACILITIES. *Delete this SSPWC subsection and replace with the following:*

Field offices, laboratories, and bathhouse facilities at the Project Site shall be removed upon completion of the Work. Buildings and equipment furnished by the Contractor at the Project Site under the provisions of this Section are the property of the Contractor.

Removal and cleanup of the field office(s) and laboratories at the Site shall be completed within five (5) Days following final acceptance of the Work under this Contract. The Contractor shall restore any damage to the Operations and Storage Yard and staging site in accordance with Subsection 8-2.4.[Payment for demobilization under Section 16 will not be paid until this work is completed.]

8-6 BASIS OF PAYMENT. *To this SSPWC subsection add the following*:

Payment for office facilities and equipment will be considered part of the Mobilization and Demobilization item, paid under Section 16 of these specifications.

[Payment for office facilities will be made as follows: twenty-five percent (25%) when completely installed, seventy-five percent (75%) prorated over the remainder of the Contract duration.]

END OF SECTION 8

SECTION 9 - MEASUREMENT AND PAYMENT

9-1 MEASUREMENT OF QUANTITIES FOR UNIT PRICE WORK. *This subsection applies as written in the SSPWC.*

9-2 LUMP SUM WORK. *To this SSPWC subsection add the following:*

A cost breakdown for the Bid shall be submitted to the Engineer within fifteen (15) Days after Award of Contract for review and approval. The approved cost breakdown schedule (Schedule of Values) will be the basis for determining the value of the monthly progress payment. The cost breakdown shall correlate with the cost loaded schedule of activities required in the Contract Documents. The total value of all construction activities (including mobilization/demobilization) shall equal the total construction Bid amount.

9-3 PAYMENT.

9-3.1 General. *This subsection applies as written in the SSPWC.*

9-3.2 Partial and Final Payment. *To this SSPWC subsection add the following:*

[PE: $50K OR LESS START Note: If contract is $50K or less but has a duration longer than three months, use the over $50K language.]

[The Contractor shall prepare and submit for review and approval by the Engineer, two payment requests. The first is for ninety percent (90%) of the contract price and is payable upon acceptance of the Work by the Engineer. The second is for ten percent (10%) and is payable thirty-five (35) Days after acceptance of the Work provided no lien has been filed against the Work.]

[PE: UNDER $50K END]

[PE: OVER $50K START]

[Unless otherwise prescribed by law, five (5) Working Days prior to the last work day of each month, or other such date mutually agreed upon by the Contractor and the Engineer, the Contractor shall prepare and submit to the Engineer, an estimate of the cumulative amount and value of acceptable Work performed by the Contractor at the Site up to that date. Said amount shall also include the value of all acceptable materials and equipment for the Contract that have been delivered and suitably stored but not yet used in the Work, subject to the requirements of Subsection 9-3.3. and the Contract Documents.

The Contractor shall promptly submit the following in response to requests by the Engineer and/or the Engineer:

1) All information and records necessary to determine the cost of the Work for purposes of estimating monthly payment.
2) All itemized statements, in a form satisfactory to the Engineer, of the actual cost of all acceptable materials delivered by the Contractor to the Site.

All monthly progress payments, except for the final progress payment, shall include Work performed up to and including the last day of the calendar month. The Contractor may defer a request for progress payment to the succeeding month by written notification to the Engineer. The Contractor's failure to sign a pay request promptly at the end of any month may cause the payment to be deferred. No payment will be made for any Work performed during a month until an Ethnic Composition of Work Force form (properly executed for that month) is received by the Engineer.

The Contractor may elect to utilize the provisions of Public Contract Code Section 22300. The Contractor has the option, at its expense, to substitute securities equivalent to the amount withheld for any money withheld by the Agency. Securities eligible for such Substitution are bank or savings and loan Certificates of Deposit, interest bearing demand deposit accounts, standby letters of credit, any other security mutually agreed to by the Contractor and the City, or securities eligible for investment pursuant to Government Code Section 16430 and approved by the City. Such securities include:

1) U.S. Treasury Bonds and Notes, Government National Mortgage Association Debentures.
2) State of California General Obligation Bonds.
3) General Obligation Bonds of any California county, city, metropolitan water district, municipal utility district, or school district. (In addition, other issues are eligible by statutory authority authorizing the issuance; each issue has to be determined on request).
4) Banks for Cooperative Debentures, Federal Intermediate Credit Bank Debentures, Federal Home Loan Bank Notes and Bonds, Federal Land Bank Bonds, Federal National Mortgage Association Debentures, Tennessee Valley Authority Bonds.
5) Certificates of Deposit issued by banks authorized to transact business in California, which are members of the Federal Deposit Insurance Corporation.

NOTE: No security shall be pledged which has a life to maturity exceeding five (5) years from the date it is pledged.

As to any such security or securities so substituted for moneys withheld, the Contractor shall be the beneficial owner of same and shall receive any interest thereon.

Securities shall, at the request and expense of the Contractor, be deposited with the Agency or with a State or Federally chartered bank as the escrow agent. The Agency shall then, upon notification by the Executive Director, pay any retained moneys to the Contractor in an amount not exceeding the value of the securities. Securities will be returned to the Contractor at the expiration of thirty-five (35) Days from the date of acceptance of the Work or as prescribed by law. There must, however, be a continued retention of the necessary securities to cover such

amounts as are required by law to be withheld pursuant to properly executed and filed notices to stop payment or as may be authorized by the Contract to be further retained. A notification of release will be issued by the Executive Director.

Any Agreement entered into pursuant to this provision shall contain, at a minimum, the following provisions:

1) The amount of securities to be deposited.
2) The terms and conditions of conversion to cash in case of default by the Contractor.
3) The termination of Assignment or escrow upon completion of the Contract and other requirements as herein provided.
4) Endorsement by the Contractor's Surety.

The monthly payments will be withheld or reduced for any of the following reasons:

1) Defective Work not remedied.
2) Materials not properly stored or protected at Site.
3) If the Contractor is not diligently or efficiently complying with the express intent of the Contract.
4) Third party claims filed.
5) Failure of the Contractor to make payments to the Subcontractor or for labor, materials and equipment.
6) Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum.
7) Damage to the Agency or another Contractor.
8) Failure of the Contractor to submit construction schedule and updated progress schedules.
9) There are unresolved Notices of Non-Compliance.
10) Damage to adjacent property.
11) Technical Manuals are not submitted.
12) As-Built Construction Plans are not kept up-to-date.
13) Failure of the Contractor to complete and submit a daily construction report.
14) Reasonable evidence that Work will not be completed within the Contract Time and that the unpaid balance will not be adequate to cover actual or Liquidated Damages for the anticipated delay.
15) Failure to carry out the Work in accordance with the Contract Documents.
16) Failure to return all equipment or tools paid for by the Agency to perform extra Work.
17) Progress photographs are not submitted.
18) Failure to submit coordination drawings.]

[OVER $50K? END]

9-3.3 Delivered Materials. *Delete this SSPWC subsection and replace with the following:*

Partial payment for materials or equipment delivered to, and stored at, the Site may be paid in the

partial progress payments pending the approval of the Engineer. The balance of the material cost shall be paid together with the installation of such material or equipment. Partial payment shall be subject to the following conditions:

1) The payment for the materials or equipment shall not exceed seventy percent (70%) of the invoice cost. The amount paid shall not exceed the total amount of the bid item less an amount estimated for installation.
2) Payment will not be made for any materials or equipment unless each individual piece of the material or equipment becomes a permanent part of the Work and has a value of more than five thousand dollars ($5,000).
3) The material or equipment is required by the Contract Documents and is specifically manufactured for the Project and could not readily be utilized or diverted to another job.
4) The Contractor shall provide secure storage facilities that have been approved by the Engineer or Inspector.
5) No payment will be made for living or perishable plant material, or for degradable materials such as rock, sand, cement, or for reinforcing steel, miscellaneous piping, off the shelf and catalog items, and similar items of construction, until they are incorporated into the Work.
6) The Contractor shall include cost loaded activities for the materials and equipment, for which payment will be requested, in the Schedule of Values. The Contractor shall provide all documentation necessary to establish the cost of the materials or equipment.
7) All Suppliers, fabricators, or manufacturers who intend to furnish materials or equipment to the Agency must file a notice with the Agency in accordance with the State of California lien laws.
8) Each Supplier, fabricator or manufacturer shall file a list with the Engineer, indicating the materials or equipment to be furnished to the Project. They shall also provide a notarized declaration from their company indicating the employees authorized to sign an unconditional release for the company. The persons signing the declaration and the unconditional release shall be identified by name and title.
9) Each request for payment shall include a notarized Unconditional Release which conforms to the California Civil Code. The release shall be signed by an authorized employee identified in the corporate declaration. The request shall include the supplier's invoice for the materials or equipment.

Material delivered to the Contractor at *any* location other than the Site may also be taken into consideration for partial payment subject to the following additional conditions:

1) Payment for the materials or equipment stored shall not exceed sixty percent (60%) of the invoice cost of the materials or equipment. Percent of the invoice paid shall be at the discretion of the Agency. The amount paid shall not exceed the total amount of the Bid item less an amount estimated for installation.
2) The Contractor shall store the materials and equipment as required in Subsection 7-10.2, in a bonded warehouse or facility approved by the Engineer. The storage site shall be located within fifty (50) miles of the geographic limits of the Agency.

The materials and equipment shall be physically segregated from all other materials or equipment within the facility and shall be identified as being the "PROPERTY OF THE CITY OF LOS ANGELES, LOS ANGELES WORLD AIRPORTS." The Contractor shall exercise all measures necessary to ensure preservation of the quality, quantity, and fitness of such materials or equipment and shall perform the manufacturer's recommended maintenance of the materials or equipment. The Contractor shall inspect the materials and equipment and submit a monthly written report to the Engineer listing all the equipment stored, the results of the inspection, and the maintenance performed.

3) The Contractor shall grant the Inspector and the Engineer access to the storage facility at any time and assist the Inspector and the Engineer in conducting a full view, piece by piece, inventory of all such material or equipment.
4) The Contractor shall provide all additional insurance necessary to insure the materials or equipment against loss of damage. The insurance provided shall be as stated in these Contract Documents. The insurance shall cover the material or equipment while stored at the approved Site, while in transit to the Site, while being off-loaded at the Site, and until the material or equipment is incorporated into the Work and the Contract is accepted by LAWA.
5) The Contractor shall be responsible for any damage to, defects therein, misfabrication thereof, or loss of the materials or equipment.
6) The Contractor shall be responsible for any resulting Project delays or consequential damages as if the Contractor were the owner of the material or equipment until it is incorporated in the Work and accepted by the Agency.
7) The Contractor shall present the storage arrangements in writing and sign a Security Agreement, which shall be submitted to the Engineer for approval by the City Attorney. This agreement shall set forth the terms of ownership, storage and insurance necessary to insure the material or equipment against damage or loss.

Payments for undelivered manufactured equipment to be incorporated into the Work, excluding "off the shelf" or catalog items, will be made when all of the following conditions exist:

1) The Equipment must be specifically designated in the Contract Documents for partial payment prior to delivery.
2) The equipment to be specifically designated for the Project could neither be readily utilized on, nor diverted to, another job.
3) A fabrication period of more than six (6) months is anticipated.

Payment will not be made for materials wasted or disposed of in a manner not called for in the Contract Documents. This includes rejected material not unloaded from vehicles, material rejected after it has been placed, and material placed outside of the limits of Work. No compensation will be allowed for disposing of rejected or excess material.

The Contractor shall absorb any and all cost incurred to meet the requirements of this Section without modification in the Contract amount.

9-3.4 Mobilization. *To this SSPWC subsection add the following*:

The contract lump sum price paid for mobilization shall include full compensation for furnishing all supervision, labor, materials, tools, equipment, and incidentals necessary for doing all the Work involved in mobilization as specified herein.

1) **General.** Mobilization and demobilization shall consist of the following which must be performed or costs incurred either prior to beginning Work on the various Contract items at the Site, or after the removal from the Site of all personnel, equipment, unused supplies, etc., after completion of the Work:

   a) Obtaining all required insurance, bonds and permits.
   b) Preparatory Work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the Site.
   c) Furnishing and erecting a field office and other facilities necessary for Work on the Project including services, equipment, supplies and incidentals to the Site.
   d) All other Work and operations as specified in the Contract Documents.

2) **Principal Items of Mobilization and Demobilization.** See Section 16 of these specifications.

3) **Basis of Payment.** See Section 16 of these Specifications.

[PE: Add the following language if you have specific items in your Contract that will be paid through an allowance.]

[9-4 ALLOWANCES. *To the SSPWC add subsection 9-4 as follows:*]

[Because of the uncertainty of the Work to be accomplished or materials to be provided, certain items of Work have been designated to be paid for out of an allowance included in the Schedule of Work and Prices submitted with the Bid. The allowances will be used to pay for these items. The Contractor will be paid for these items on the basis of "extra Work" (Subsection 3-3 of the General Provisions). The Contractor's mark-up shall be all-inclusive of supervision and coordination of the Subcontractor's Work and no additional compensation shall be allowed. Any and all unused portions of the allowances will not be paid to the Contractor.]

END OF SECTION 9

SECTION 10 – MISCELLANEOUS OTHER REQUIREMENTS

10-1 CONTRACTOR'S CONSTRUCTION SCHEDULE AND REPORTS

See Section 19 of these Specifications for requirements relative to the Contractor's Construction Schedule and Reports.

10-2 CONTRACTOR'S CONSTRUCTION SCHEDULER

See Section 19 of these Specifications for requirements relative to the Contractor's Construction Scheduler.

10-3 OPERATIONAL SAFETY ON THE AIRPORT

The Contractor shall conduct all operations in a manner that will cause no interference with aircraft traffic or normal operation of the airport. The Contractor shall furnish flaggers, escorts and Foreign Object Debris (FOD) control (sweepers) to regulate the movements of vehicles and equipment when it is necessary for a vehicle or piece of equipment to cross an active taxiway, or when working within **[125]** feet of an active taxiway or **[250]** feet of an active runway. When crossing a NAVAID critical area, workers and equipment shall heed the hold instructions of the on-site flagger, who is in communication with the LAWA Inspection or Operations staff, until cleared to proceed. No crossings of active runways will be allowed. Aircraft shall always have the right-of-way.

In all operations, the Contractor shall be governed by the regulations and rules of LAWA and shall cooperate fully with the Engineer and Airport Management. The Contractor shall refer to Section 7-10.5 of these specifications regarding Operation of Vehicles on the AOA. The Contractor shall also be bound by the operational safety requirements outlined in the Federal Aviation Administration (FAA) Advisory Circular No. 150/5370-2, latest edition, entitled "Operational Safety on Airports During Construction", including Appendix 1, "Special Safety Requirements During Construction" and the provisions thereof. This document is attached to these Specifications as Appendix A. Additional information and requirements relating to operations at the Airport are contained in Appendix B, "Instructions to Contractors". Should there be a conflict in the requirements between this Advisory Circular and the requirements in the Plans and Specifications, the most restrictive shall govern.

Construction phasing shall be accomplished in accordance with Section 11 of these Specifications.

10-3.1 Introduction

[Los Angeles International Airport] is a complex operating facility which is governed by a very strict set of operating rules to insure the safety of the traveling public, the operators of the various airlines, and those individuals who function as support personnel to the facility. It shall be recognized and understood that the Contractor is required to comply with the most current edition requirements contained in FAA Advisory Circulars as they pertain to this project. It shall be understood and accepted that the Contractor has familiarized himself with general Airport operations and has taken these into consideration in arriving at his bid prices and in scheduling his various activities.

Following are the general safety operations and objectives that shall be achieved to maximize safety and to minimize time and economic loss to the aviation community, construction contractors, and others directly or indirectly affected by the Project. The Contractor shall consider these objectives in consideration when formulating schedules and operational activities (see Section 11 of these Specifications for specifics on phasing and work hour restrictions). The Contractor shall be responsible for controlling his operations and the operations of subcontractors (at all levels) and suppliers so as to comply with the requirements of this section as listed below:

A. Keep the airport operational for all users.

B. Minimize delays to aircraft operations.

C. Maximize safety of aircraft movement and airport operations as a whole.

D. Minimize delays to construction operations.

E. Minimize airport operation and construction activity conflicts.

These requirements are considered a minimum. Detailed construction Safety and Phasing Plans are included in the contract drawings. Where conflicts occur between the requirements in this section and those indicated on the construction Phasing Plans, the more stringent shall govern.

10-3.2 Requirements and Regulations Relating to the Operation of Motor Vehicles

A. General

(1) During the term of this Contract, the Contractor shall recognize and abide by the following rules and controls as they may be modified by Federal regulations.

(2) In addition to these regulations, the Engineer is empowered to issue such other instructions as may be deemed necessary for the safety and well being of Airport users or otherwise in the best interests of the public.

B. Operation of Motor Vehicles

(1) General:

a. Motor vehicle operations within and on the Airport premises shall be governed generally by the provisions of the California State Motor Vehicle Codes and Traffic Direction procedures and signals for turns. Lights and safe-driving precaution shall be in conformity therewith. In addition, motor vehicles shall conform to all special regulations prescribed by the Los Angeles International Airport or procedures imposed pursuant to Los Angeles International Airport regulations by the Engineer. Refer to Section 7-10.5 of these specifications.

b. Traffic on perimeter roads, enplaning and deplaning drives, public thoroughfares and parking areas of the Airport is limited to those vehicles properly licensed to operate on public streets and highways.

c. All vehicular equipment in the AOA, access road, aircraft parking or storage areas shall at all times comply with any lawful signal or direction of LAWA employees. All traffic signs, lights, and signals shall be obeyed, unless otherwise directed by LAWA employees.

d. Every person operating motorized equipment of any character on any area shall operate the same in a careful and prudent manner and at a rate of speed posted or fixed by this section and at no time greater than is reasonable and proper under the conditions existing at the point of operating, taking into account traffic and road conditions, view, obstructions, and shall be consistent with all conditions so as not to endanger the life, limb, or property or the rights of others entitled to the use thereof.

(2) Operation of Vehicles within the AOA:

a. All motor vehicles that enter the AOA shall possess exhaust systems which are protected with screens, mufflers, or other devices adequate to prevent the escape of sparks or the propagation of flame.

b. All vehicles (powered and non-powered) within the AOA shall be equipped with reflectors or lights on both front and rear ends and on the sides.

c. All Contractor vehicles shall be equipped with operable yellow flashing beacons, beacons must be lighted during all periods of vehicle operation and while the vehicle is on the AOA.

d. No person shall operate any motor vehicle or motorized equipment in the AOA of the Airport unless such motor vehicle or motorized equipment is in a safe and mechanically reliable condition for such operation.

e. Any person operating equipment in the Air Operations Area shall, in addition to this section, abide by all existing Federal Aviation Administration and other governmental rules and regulations.

f. No person shall operate any motor vehicle or motorized equipment on the aircraft movement or non-movement areas of the Airport at a speed in excess of 20 miles per hour, or the posted speed limit, whichever is lower, less where conditions warrant, unless specified otherwise elsewhere. Designated motor vehicle drive lanes shall be utilized where provided unless specific authorization to the contrary is given by the Engineer.

g. No person operating a motor vehicle or motorized equipment in the AOA shall in any way hinder, stop, slow, or otherwise interfere with the operation of any aircraft on the Airport.

h. All aircraft and emergency vehicles have priority over Contractor vehicles. Contractor vehicles shall yield right-of-way to aircraft and emergency vehicles. Contractor shall ensure that under no circumstances will any contractor or subcontractor or other vehicle associated with the job pass beneath any part of an aircraft or loading bridge, or block the access to any parking gate or delay any aircraft movement.

i. Vehicles shall remain within established drive lanes. It is prohibited to use runways or taxiways or adjacent field areas unless specifically indicated on the Drawings. It is emphasized that the contractor's authority to operate does not extend to active aircraft movement area. The Contractor shall operate along established haul routes with prior approval of the Engineer.

j. Contractor vehicles shall not deviate from approved haul routes specified on the Drawings. No crossover between construction sites is allowed. To move from one construction site to another, vehicles must exit the AOA via the approved haul route and access point and re-enter through the approved access gate and haul route for the next construction site.

k. Escorts: At all time during work within **[250]** feet of the centerline of an operating runway or **[125]** feet of the centerline of an operating taxiway, or when entering or crossing an active movement area, vehicles shall be accompanied by an approved radio-equipped escort car.

l. When construction vehicles, other than those routinely used in the aircraft movement area and runway approach area, are required to travel over any portion of that area, they shall be escorted by an approved escort vehicle.

C. Parking

(1) No parking is permitted on any Airport roadway as the primary purpose of the Airport roadways is for motor vehicle traffic.

(2) No person shall park any motor vehicle, other equipment, or leave materials in the AOA of the Airport, except in a neat and orderly manner and at such points as prescribed by the Contract Documents.

(3) No person shall park any motor vehicle or other equipment or leave materials in the AOA of the Airport within 15 feet of any fire hydrant or standpipe.

(4) Parking of construction workers' private vehicles shall also be in a public or private parking facility outside the AOA. Under no circumstances will vehicles or equipment be parked within 10 feet of the Airport Perimeter Security fence line.

D. Vehicle Identification

(1) All vehicular equipment operating within the AOA must display signs of commercial design on both sides of the vehicle which identify the vehicle as belonging to the Contractor firm.

(2) Vehicles that appear at access gates without signs on both sides of the vehicle will be denied access. Vehicles found to be missing signs within the AOA will be escorted off the jobsite and not be permitted to re-enter until signs have been installed.

(3) All Contractor vehicles must be equipped with 3-foot by 3-foot flags having a checkered pattern of International orange and white squares at least 1 foot on each side. For fabric color specifications, see FAA AC 150/520-5B, Appendix A. Attach flag on top of vehicles with rigid pole so that the flag will be visible at all times. Vehicles without flags will not be permitted to enter the AOA.

E. Load Limits

When using airport roadways, the Contractor shall restrict the gross combination weight to 80,000 pounds, single-axle maximum weight of 20,000 pounds, and a tandem axle weight maximum of 32,000 pounds. The vehicle weights are subject to verification by the Engineer.

F. Other Vehicle Requirements. See **[Appendix] [Section] [ ]** of these Specifications for other vehicle requirements that will apply to this project.

When using airport roadways, the Contractor shall restrict the **[gross combination][axle]** weight to **[ ]** pounds.

10-3.3 Requirements and Regulations Relating to Operators of Vehicles

A. All drivers operating vehicles on airport property must carry a valid United States driver's license on his person, appropriately endorsed for the type of equipment being operated.

B. The Contractor shall promptly turn in all badges to LAWA Los Angeles Badging Office for employees who will no longer be working at the construction site. All Contractor badges must be turned in at the end of construction. Charges apply to badging, fingerprinting, and the failure to return badges. All such charges shall be the Contractor's sole responsibility.

C. Drivers designated to operate vehicles in the AOA shall receive special drivers training and be approved by the Airport before being allowed to operate within the AOA or be escorted by an approved escort. Drivers operating outside the AOA may operate vehicles without attending the special drivers training course.

10-3.4 Requirements for Orientation of Contractor Personnel and Project Meetings

A. Air Operations Orientation

(1) After Award of the contract has been issued, but prior to the start of the construction, arrange with the Engineer to have all supervisory and job office personnel assigned to this project attend an "Air Operations Orientation." This orientation will be conducted by the Airport for discussion of the rules and regulations pertinent to this Contract. Attendees will include the Engineer, the Contractor's General Manager, and the designated Safety Officer.

(2) At least one first line supervisor who has attended the orientation shall be present in the vicinity of the active runways and taxiways at all times when construction activities require men or equipment in these areas. The Contractor and Engineer shall keep a record of the individuals who have attended the orientation. Contractor employees who have not attended the Airport Operations Orientation will not be permitted to work within **[250]** feet of the centerline of the runways, taxiways or other areas of Aircraft Operations.

B. The Air Operations Orientation may be conducted as part of the pre-construction meeting and shall not be considered an educational course in Air Operations Safety , but a discussion of existing rules or regulations related to airport activities. The Contractor shall be fully responsible and liable for the actions of his employees, subcontractors, agents, or representatives.

C. Safety and Security Meetings

An airport safety and security meeting will be conducted with the Contractor's staff after the award of the contract and prior to commencing construction and weekly thereafter. The Contractor shall identify one individual as Safety Officer who will be responsible for conducting the meetings.

D. Safety Plan Submittal

At the pre-construction meeting, the Contractor will submit a Safety Plan containing, at a minimum, the following:

(1) Identification and 24-hour phone/pager contact for Safety Officer.

(2) List of individuals who will be authorized escort drivers.

(3) List of access gates, gate hours and names of gate guards. List of access gates, gate hours and name of gate proctors.

(4) Identification of individual(s) to be responsible for communication base for escort vehicles. This base radio will be the only one authorized to transmit to the LAWA Ops/Inspection. All escort vehicles must have receiving radios to monitor transmissions from the LAWA Ops/Inspection.

(5) Description of methods to be employed to ensure that all active taxiway crossings will remain free of foreign object debris (FOD).

(6) Description of methods to be employed to ensure that FAA Safety Area requirements are met relative to grade, surface smoothness, wheel load support, etc. in Runway and Taxiway Safety Areas.

(7) Proposed notification and action procedures to be employed for each needed night runway closure.

10-3.5 Security Requirements

A. General Intent. It is intended that the Contractor shall comply with all requirements of the Airport Security Plan (ASP) and with the security requirements specified herein.

B. The Contractor shall designate, and submit to the Engineer in writing, the name of his Contractor Safety Officer (CSO). The CSO shall conduct the Weekly Safety Meetings and shall be accountable for the security requirements for the Contractor.

C. The Contractor's Safety Officer (CSO) will be responsible for all security precautions. Prior to the commencement of the work, the CSO shall provide the Engineer an outline of a proposed security protection plan as described in 10-3.4D above (i.e., challenging, ID

checks, gate control and general site security) for all work contemplated under the contract.

D. Identification/Access Badging

All Contractor personnel working on the project shall have Los Angeles International Airport (LAX) issued identification/access badges. Refer to Appendix **[ ].**

E. Perimeter Fence Security

(1) Contractor shall not open gates or remove fencing without approval of the Engineer. Adequate precautions shall be taken to prevent entrance of unauthorized persons to Airport-restricted areas or inadvertent entry of dogs or large animals into the AOA.

(2) Prior to securing work each evening, Contractor shall ensure that all access gates which have been opened are closed and locked, and that perimeter fencing is restored to a condition that will maintain present security standards.

(3) Ten Foot Rule: No Contractor will be permitted to store materials, park equipment or erect permanent or semi-permanent structures within ten (10) feet of either side of the AOA perimeter security fence.

(4) Use of Gates: The gates shown on the drawings shall be used for access to the worksites. Use of a gate for continuous access will require the gate be manned by a badged guard. The Contractor shall schedule with the Engineer a minimum of 24 hours prior to requiring access through any AOA gates. Use of Gates: The gates shown on the drawings shall be used for access to the worksites. Use of a gate for AOA access will require the gate be manned by LAWA police and a Contractor provided gate guard.

(5) Use of Gate Guards: Gate guards shall be provided by the Contractor. See Section 17 of these Specifications.

(6) Prior to removing or making holes in the Airport perimeter fencing, the Contractor shall obtain permission and written approval from the Engineer, and take adequate precautions to prevent entry of unauthorized personnel or animals.

F. Other Safety/Security Requirements. See **[Appendix][Section][ ]** of these Specifications for other requirements that may apply.

10-3.6 Interruptions and Stoppages of the Work Due to Aircraft Operations and Hazardous Conditions

A. Work Stoppages

(1) Construction may be stopped by the Engineer, any time he considers that the intent of the regulations regarding safety or Security Requirements are being violated or that a hazardous condition exists. This decision to suspend the operation will be final and will only be rescinded by the Engineer when satisfied that the Contractor has taken action to correct the condition and prevent recurrence.

(2) Frequent inspections will be made by the Engineer or his authorized representative during the critical phases of the work to insure that the Contractor is following the recommended safety procedures. The Inspector shall report any violations or potential safety hazards to the Engineer who will in turn advise the Contractor of the concern for immediate correction by the Contractor.

(3) Construction may also be stopped or suspended by Airport Operations, through the Engineer, during periods of inclement weather, such as low visibility, or when it is necessary to provide an extra margin of safety to aircraft operations, or reduce other activities to keep the airport operational. See Section 6 of these Specifications.

B. Intermittent Construction Operations

(1) Work under this contract will occur in the AOA. Heavy construction may require closing of certain areas by the Airport. However, some work may be done on an intermittent basis. The Contractor shall maintain constant communication with the Engineer when working on an AOA location, and will immediately obey all instructions from the Engineer. Failure to obey instructions or maintain proper communication will be cause to suspend the Contractor's operations in such areas until satisfactory conditions are assured. Intermittent delays which can be expected to be a normal condition while working on an active airport include holding for aircraft on active taxiways, and holding short of NAVAID critical areas on the haul road in periods of low visibility when aircraft are on landing approach. Such delays shall be considered incidental to the cost of the construction and no compensation or time extensions will be granted for such delays.

(2) When directed to cease construction and move from the area, the Contractor shall immediately respond and move all material, equipment and personnel outside areas. Operations shall not be resumed until directed by the Engineer. Every reasonable effort will be made to cause minimum disturbance to the Contractor's operations; however, no guarantee can be made as to the extent to which disturbance can be avoided.

(3) Limitation of Operations: The Contractor shall be responsible for controlling his operations and those of his subcontractors so as to provide for the free movement of aircraft in the operating areas of the AOA.

10-3.7 Requirements and Regulations Affecting the Conduct of the Work

A. General

(1) Requirements to Begin Work: Before starting work, the Contractor shall provide, and have available, all flags, signs, barricades, lights, electrical generators, and other equipment and materials as may be required for the protection of air traffic, vehicular traffic and the construction work. All personnel shall have the proper identification badges and have received the required training and instruction.

(2) No burning is permitted on Airport property.

(3) Smoking by personnel is prohibited on the AOA.

(4) Construction Activity and Aircraft Movements:

a. Prior to the start of the construction activities affecting aircraft movement areas, the safety requirements relating thereto will be coordinated by the Engineer between the Airport Operations, air carriers, fixed base operators, other users and appropriate representatives of the FAA. This coordination will be based on the Contractor's approved construction schedule with the primary purpose of compliance with the contract document requirements.

b. For construction activity to be performed in other than the AOA, the storage of materials and parking of equipment, when not in use or about to be installed, should not encroach upon the AOA. In protecting operational areas, the minimum clearances maintained for runways shall be in agreement with Federal Aviation Regulations (FAR) Part 77.

c. When necessary to accomplish construction within areas defined by FAR Part 77, while aircraft operations are in progress, the following minimum distances from runway, taxiway edge and runway approach area shall be maintained, unless otherwise specified:

[Air Carrier] [ ] Airport

Distance from runway centerline - **[250]** feet
Distance from taxiway centerline - **[125]** feet
Distance from runway threshold
(Longitudinally) – **[1000]** feet

(5) Limitation of Construction Activities:

a. No lips or drop-offs will be allowed between temporary panels or surfaces and adjacent pavement, or between new slabs and adjacent pavement. Other construction shall not result in lips greater than 1 inch, for pavement traveled by aircraft; and 3 inches, for edges between old and new surfaces at edges and ends not traveled by aircraft.

b. Open-flame welding or torch-cutting operations are prohibited unless adequate fire and safety precautions are provided and have been approved by the Fire Chief through the Engineer.

c. During working hours, open trenches, excavations and stockpiled material at the construction site shall be prominently marked with barricades and lights as shown on the drawings.

d. Stockpiled material for use during the current work shift shall be located within the barricaded work area and limited in height and constrained in a manner to prevent movement resulting from aircraft blast or wind conditions. No material may be stored in the work areas during non-working hours.

e. The Contractor will ensure that all lighting fixtures are shielded to protect against interference with the vision of pilots and air traffic controllers.

f. During non-working hours, all trenches and excavations outside of the barricaded work areas shall be backfilled or covered.

g. Non-working hours shall be defined as those hours when construction is not taking place within a work area.

B. Construction Adjacent to Runways

(1) All equipment and material above the runway centerline grade and within a distance of **[250]** feet, or as otherwise shown on the phasing plans, from the runway centerline must be removed when the runway is being used by aircraft.

(2) Within **[250]** feet of the runway centerline, all open trenches, lips greater than one inch and drop-offs greater than three inches must be filled, covered, or sloped when the runway is being used by aircraft. Disturbed turf areas, open graded soils, crushed aggregate, or other unbound granular materials must be covered and secured or treated in a manner approved by the Engineer so that these materials do not result in FOD or dust due to exposure to jet blast and/or weather.

(3) Notification to Airport Operations, by way of the Engineer, is required prior to beginning any construction within **[250]** feet of a runway centerline or **[125]** feet of a taxiway centerline which is being used for aircraft operations. Notification of the proposed construction should be made a minimum of fourteen (14) days prior to beginning work.

C. Construction Adjacent to Taxiways

(1) Except as otherwise described in the construction phasing plans, no equipment or material within 125 feet of a taxiway centerline, or as otherwise specified, shall be above the taxiway centerline grade while the taxiway is being used by aircraft.

(2) Open trenches or abrupt drop-offs may be made adjacent to taxiway pavement edges, providing this work is temporarily covered, approved by the Engineer and coordinated with Airport Operations, who will in turn coordinate the Notice to Airmen (NOTAM). Open graded soils, crushed aggregate, or other unbound granular materials must be covered and secured or treated in a manner approved by the Engineer so that these materials do not result in FOD or dust due to exposure to jet blast and/or weather.

(3) Marking and lighting of work areas adjacent to taxiways shall be required and approved by the Engineer.

D. Barricades and Marking of Barricades

(1) Continuous burning “Standing Red” barricade lights and/or other lighted hazard devices stipulated on the phasing plans shall be operative at all times while in place. It shall be the Contractor's responsibility to immediately repair or replace any light or flasher that is not operating.

(2) Barricades shall be in place prior to commencing construction operations, and shall be maintained in near new appearance for the life of the contract.

(3) Lighted “X” runway closure markers shall be in place over the runway numerals during any runway closure.

(4) See Section 62 of these Specifications for additional requirements on barricades.

E. Closures

No ramp, apron, taxiway, or runway area shall be closed to aircraft without approval of the Engineer. This will enable Notices to Airmen (NOTAMS), or other advisory communications to be issued. A minimum of 72 hours notice of requested closing shall be directed to the Engineer. The Engineer will arrange inspections prior to opening any area to air traffic. Any waste

material, and/or debris must be removed from aprons promptly to avoid possible damage to aircraft.

F. Debris

(1) Debris Control: When Airport roadways and public highways are used in connection with construction under this contract, the Contractor shall remove all debris from the surfaces of such roadways. Trucks and equipment shall have all accumulated dirt, mud, rocks and debris removed before accessing the AOA, and when leaving the work area. Loads shall be struck flush and secured to prohibit loss of material. If spillage occurs, such roadways shall be swept clean immediately after such spillage to allow for safe operation of vehicles as determined by the Engineer. If the Contractor is negligent in cleanup and LAX forces are required to perform the work, the expense of said cleanup shall be paid by the Contractor.

(2) No loose material or waste (FOD), capable of causing damage to aircraft or capable of being ingested into jet engines may be left in the working area on or next to runways, taxiways, ramps, or aprons. The Contractor shall direct special attention to all areas which are operational to aircraft during construction. These shall be kept clean and clear of all materials or debris at all time. Any food waste shall be promptly cleared to prevent attracting birds and animals.

G. Existing Pavements and Facilities

The Contractor shall preserve and/or protect existing and new pavements and other facilities from damage due to construction operations. Existing pavements, facilities, utilities, or equipment which are damaged shall be replaced or reconstructed to original strength and appearance at the Contractor's expense. The Contractor shall take immediate action to replace any damaged facilities and equipment and reconstruct any damaged area which is to remain in service.

Any distress appearing within and/or jeopardizing Caltrans Right-of-Way due to the proposed construction should immediately be notified to the Engineer and be repaired by the contractor at the Contractor’s expense to the satisfaction of the Engineer.

H. Storage Areas

(1) The Contractor Staging Area, as depicted on the plans, shall be used to store all idle equipment, supplies and construction materials. Storage shall not interfere with operational areas.

(2) When not in use during working hours, and at all other times, all material and equipment shall be stored at the storage site indicated on the drawings unless prior approval is provided by the Engineer.

(3) The Contractor shall not store materials or equipment in areas in which the equipment or materials will affect the operation of FAA electronic equipment.

(4) All equipment storage and movement shall have prior written approval of the Engineer.

(5) No materials may be stored on the Aircraft Operating Area (AOA).

(6) Contractor's vehicles, equipment and materials shall be stored in areas designated on the drawings. Upon completion of the work, the storage areas shall be cleaned up and returned to their original condition to the satisfaction of the Engineer.

(7) During all non-working hours, equipment shall be parked in the Contractor's Staging area designated on the drawings with the restrictions listed thereon. Parking of construction workers' private vehicles shall not be allowed within storage areas located on the AOA.

(8) The Staging area shall be used to store all bulk materials needed for the project must be fenced at the Contractor's expense. However, barricades with yellow flashing lights shall be installed where potential conflicts with aircraft or ground vehicular traffic exists. Stockpiles shall not penetrate the FAR Part 77 imaginary surfaces or present FOD problems.

(9) Equipment and materials shall not be stored between runways, except as approved, in writing, by the Engineer.

10-3.8 Obstructions to Navigation

A. Penetrations of the imaginary surfaces defined in FAR Part 77 shall not be permitted without advance notification of, and approval by, the Engineer. It may be necessary to file FAA Form 7460-1 with the FAA to obtain approval prior for operation of exceptionally tall equipment, including but not limited to vehicles, cranes, or other construction equipment, structures, stockpiled materials, excavated earth, etc. It shall be the Contractor's sole responsibility to file this document. Allow at least 45 days for FAA and review and approval prior to expected use of such equipment.

B. When penetrations more than 15 feet above ground level (AGL) are unavoidable, they shall be brought to the attention of the Engineer, as far in advance as possible to allow NOTAMS to be prepared and distributed to appropriate FAA divisions for publication and dissemination. Contractor shall comply with the provisions of AC 70/7460-1, latest edition, in the marking and lighting of obstacles. The Contractor shall allow at least 45 days for FAA review and approval. No delays will be granted the Contractor for his failure to submit the necessary documents in a timely manner.

C. Appropriate sketches shall be prepared by the Contractor with precise locations shown on the Airport Layout Plan, Height Restriction Plan, or other similar drawing, along with elevations depicting the obstructing object's relationship to the imaginary surfaces.

10-3.9 Daily Inspections

The Engineer will conduct a daily inspection of each construction site before workers leave for the day to ensure that areas surrounding the sites are safe for aircraft operations. Inspector(s) will be watchful for food scraps and debris that can be ingested into aircraft engines (FOD), loose polyethylene and other light materials capable of being blown onto aircraft movement areas by wind, unlighted construction and obstruction lights, vehicles and equipment left outside construction areas, construction areas left unlocked, access gates left open, weak partitions or fences, etc. All discrepancies shall be corrected before workers depart from the work site.

Inspectors will review potentially hazardous conditions which may occur during airport construction and maintenance include, but are not limited to the following:

A. Trenches, holes, or excavation on or adjacent to any open runway or related safety area.

B. Unmarked/unlighted holes or excavations in any apron, open taxiway, open taxilane, or related safety area.

C. Mounds or piles of earth, construction materials, temporary structures, or other objects on or in the vicinity of any open runway, taxiway, taxilane or in a related safety, approach or departure area.

D. Pavement drop-offs or pavement turf lips (either permanent or temporary) which would cause, if crossed at normal operating speeds, damage to aircraft that normally use the airport.

E. Vehicles or equipment (whether operating or idle) on any open runway, taxiway, taxilane, or in any related safety, approach or departure area.

F. Vehicles, equipment, excavations, stockpiles, or other materials which could impinge upon NAVAID critical areas and degrade or otherwise interfere with electronic signals from radios or electronic NAVAIDs or interfere with visual NAVAID facilities. NAVAID critical areas are shown on the plans.

G. Unmarked utility, NAVAID, weather service, runway lighting, or other power or signal cables that could be damaged during construction.

H. Objects (whether marked/flagged or not) or activities anywhere on or in the vicinity of airport which could be distracting, confusing, or alarming to pilots during aircraft operations.

I. Unflagged/unlighted low visibility items (such as tall cranes, drills, etc.) in the vicinity of an active runway, or in any approach or departure area.

J. Misleading or malfunctioning obstruction lights.

K. Unlighted/unmarked obstruction in an approach to any open runway.

L. Inadequate approach/departure surfaces (needed to assure adequate landing/takeoff clearance over obstructions or work or storage areas).

M. Inadequate, confusing, or misleading (to pilots) marking/lighting of runways (including, displaced or relocated thresholds), taxiways, or taxilanes.

N. Water, dirt, debris, or other transient accumulation which temporarily obscures pavement marking, pavement edges, or derogates the visibility of runway/taxiway marking, lighting or of construction and maintenance areas.

O. Inadequate or improper methods of marking, barricading, or lighting temporarily closed portions of airport operation areas.

P. Trash or other materials with foreign object damage (FOD) potential, whether on runways, taxiways, aprons or related safety areas.

Q. Inadequate fencing or other marking to separate construction or maintenance areas from open aircraft operating areas.

R. Inadequate control of vehicle and human access, and non-essential, non-aeronautical activities, on open aircraft operating areas.

S. Improper radio communication maintained between construction/ maintenance vehicles and LAWA Ops/Inspection or other on-field communications facility (e.g., FAA Flight Service Station (FSS) or Unicom radio).

T. Construction/maintenance activities or materials which could hamper airport rescue and fire fighting (ARFF) vehicle access from ARFF stations to all parts of the runway/taxiway system, runway approach and departure areas, or aircraft parking locations.

U. Bird attractants such as edibles (food scraps, etc.), trees, brush, other trash, grass/crop seeding, or pond water on or near the airport.

V. Personnel at the construction site without proper LAX identification.

W. No escorts for persons at the job site without proper identification.

X. Vehicles involved in the project that do not meet the safety requirements of LAX Rules and Regulations.

Y. Improperly marked, lighted and flagged vehicles involved in the project.

The time restrictions for all work shifts, including the nightly work shifts, are totally inclusive of the Contractor moving onto the site, performing work activities, performing all clean-up, having the work area, pavements, and haul routes inspected and approved by the inspector(s) and moving off the site. The Contractor shall provide adequate lighting for the needs of the inspection personnel.

Any Aircraft Movement Surface or adjoining runway, taxiway or taxilane safety area that does not pass inspection must remain closed until such time cleanup is performed and approved.

10-3.10 Emergency Procedures

A. The Contractor shall familiarize himself with airport emergency procedures and shall conduct his operation so as not to conflict with such events. Clear routes for Airport Rescue and Fire Fighting (ARFF) equipment shall be maintained in operational condition at all times.

B. In case of an emergency caused by an accident, fire, or personal injury or illness, Airport Police are to be immediately notified. Police will coordinate with other emergency agencies as necessary. The Contractor shall also notify the Engineer and Operations so that any coordination or closures that may be required can be addressed immediately.

10-3.11 Administrative Requirements

A. Applicability

The provisions of this section shall apply to the Prime Contractor, subcontractors at all tiers, suppliers and all others which may have access to the Air Operations Area by way of the Contractor's activities.

B. Exclusion from Claims

Impacts caused by failure of the Prime Contractor, subcontractors at all tiers, and all others to comply, implement and maintain the provisions of this section shall not be cause for a claim of delay or increased cost to LAWA.

10-4 MARKING OF EQUIPMENT/RESTRICTIONS ON CRANES

Each vehicle or piece of equipment anywhere on the Airport that extends higher than 15 feet above ground shall be equipped with a flag mounted firmly on the highest part of the equipment,

and shall be obstruction lighted per the current edition of FAA Advisory Circular 70/7460-1 when the visibility is less than three (3) miles. Federal Aviation Regulation Part 77, states that no permanent or temporary structure can exceed an imaginary surface which begins 500 feet south and north of the runway centerline, and extends outward and upward at a 7:1 ratio. As long as visibility is at or above 1 mile, there are not restrictions on the height of the crane. In addition, the crane must be obstruction lighted per Advisory Circular 70/7460-1 whenever visibility is less than three (3) miles and it must be lowered at the end of the day. Flags should be rectangular in shape with stiffeners to keep them from dropping in calm wind. This flag shall be not less than 3 feet square consisting of five 1-foot squares of international orange color and four 1-foot squares of white color.

Depending on the location of the construction site, there may be severe restrictions on the use of equipment that extends skyward, such as cranes and concrete pumping booms. Some of these restrictions include limitations on the height cranes can be extended during times of reduced visibility, e.g., cranes may not be raised unless visibility is 2 to 3 miles or greater. Contact the LAWA Engineering Bureau for further information, prior to submitting a bid, if cranes or other vertically extendable equipment will be used on the project.

If cranes or other equipment exceeding 15 feet in height are to be used, the Contractor will be required to submit for approval the FAA's application Form 7460-1 to:

[CONFIRM ADDRESS]

Federal Aviation Administration
Attention: Airports Division, AWP-600
P.O. Box 9207
Los Angeles, CA 90009

10-5 DOCUMENT CONTROL SERVICES ALLOWANCE

Document Control Services allowance is provided for the use of a LAWA-selected consultant(s) to provide construction document control and construction administration assistance for the Engineer during the construction phase of the project. The Contractor shall be paid for the Document Control Services Allowance based upon the actual invoice payment, plus a three (3%) mark-up for the Contractor's coordination and processing cost. No other compensation beyond the 3% mark-up shall be granted to the Contractor. All invoices from the LAWA-selected consultant shall be approved by the Engineer prior to the Contractor payment of said invoice. After payment to the consultant by the Contractor, the Contractor will be compensated under this allowance item as stipulated above. Any and all unused portions of the allowance will not be paid to the Contractor.

[10-6 ESCROW BID DOCUMENTS]

[A. Scope

(1) This Section requires that the three (3) low bidders submit, within the specified time after receipt of bids, one (1) copy of all documentary information including, but not limited to, electronic files generated in preparation of bid prices for this project. This material is hereinafter referred to as "Escrow Bid Documents". The Escrow Bid Documents of the Contractor will be held in escrow for the duration of the Contract.

(2) The successful Bidder agrees, as a condition of the award of the Contract, that the Escrow Bid Documents constitute all of the information used in preparation of the Bid, and that no other bid preparation information shall be considered in resolving disputes or claims. The successful bidder also agrees that nothing in the Escrow Bid Documents shall change or modify the terms or conditions of the Contract Documents.

B. Ownership

(1) The Escrow Bid Documents are, and shall always remain, the property of the Contractor, subject to joint review by the City and the Contractor as provided herein. The Escrow Bid Documents are proprietary and secret information belonging to the Contractor and exempt from the Federal Freedom of Information Act, California Public Records Act, and the Los Angeles City Freedom of Information Act.

(2) The City stipulates and expressly acknowledges that the Escrow Bid Documents, as defined herein, constitute trade secrets. This acknowledgment is based on the City's express understanding that the information contained in the Escrow Bid Documents is not known outside the Bidder's business, is known only to a limited extent and only to a limited number of employees of the Bidder, is safeguarded while in the Bidder's possession, is extremely valuable to the Bidder and could be extremely valuable to the Bidder's competitors by virtue of it reflecting the Bidder's contemplated techniques of construction. The City acknowledges that the Bidder expended substantial sums of money in developing the information included in the Escrow Bid Documents and further acknowledges that it would be difficult for a competitor to replicate the information contained therein. The City further acknowledges that the Escrow Bid Documents and the information contained therein are made available to the City only because such action is an express prerequisite to award of the Contract. The City acknowledges that the Escrow Bid Documents include a compilation of information used in the Bidder's business, intended to give the Bidder an opportunity to obtain an advantage over competitors who do not know of or use the contents of the documentation. The City further agrees to safeguard the Escrow Bid Documents, and all information contained therein, against disclosure to the fullest extent permitted by law.

C. Purpose

(1) The purpose of the Escrow Bid Documents procedure is intended to create a spirit of cooperation in an atmosphere of honesty and candor between the City and the Contractor.

(2) Escrow Bid Documents will be used to assist in the negotiation of price adjustments and Change Orders and in the settlement of disputes and claims. They will not be used for pre-award evaluation of the Contractor's anticipated methods of construction or to assess the Contractor's qualifications for performing the work.

D. Format and Contents

(1) Bidders may submit Escrow Bid documents in their usual cost estimation format; a standard format is not required. It is not the intention of this Section to cause the Bidder extra work during the preparation of the Bid, but to ensure that the Escrow Bid Documents will be adequate to enable complete understanding and proper interpretation for their intended use. The Escrow Bid Documents shall be in English.

(2) It is required that the Escrow Bid Documents clearly itemize the estimated costs of performing the work of each Bid item contained in the Bid schedule. Bid items should be separated into sub-items as required to present a complete and detailed cost estimate and allow a detailed cost review. The Escrow Bid Documents shall include all quantity takeoffs, crew, equipment, calculations of rates of production and progress, copies of quotations from Subcontractors and Suppliers, and memoranda, narratives, add/deduct sheets, and all other information used by the Bidder to arrive at the prices contained in the Bid. Estimated costs should be broken down into the Bidder's usual estimate categories such as direct labor, repair labor, equipment ownership and operation, expendable materials, permanent materials, and subcontract cost, as appropriate. Plant and equipment and indirect costs should be detailed in the Bidder's usual format. The Contractor's reallocation of indirect costs, contingencies, markup and other items to each bid item shall be identified.

(3) All estimates for items of work that are based in whole or in part upon any baseline statements or information in the Geotechnical Baseline Report (GBR), shall clearly reference the baseline statements used. Contractor shall have no right to an adjustment in the Contract Price or the Contract Completion Date due to Differing Site Conditions of the General Conditions unless such baseline statements have been clearly identified in the Escrow Bid Documents.

(4) All cost shall be identified. For bid items amounting to less than $10,000, estimated units costs are acceptable without a detailed cost estimate, provided that labor, equipment, materials, and subcontracts, as applicable, are included and

provided that indirect costs, contingencies, and markups, as applicable, are allocated. Bid documents provided by the City need not be included in the Escrow Bid Documents unless needed to comply with the following requirements.

E. Submittal

(1) The Escrow Bid Documents shall be submitted by the three (3) low Bidders in sealed containers within twenty four (24) hours after the time for receipt of Bids. The containers shall be clearly marked on the outside with the Bidder's name, date of submittal, project name and the words "Escrow Bid Documents."

(2) The Escrow Bid Documents shall be accompanied with the certification (a sample is included), signed by an individual authorized by the Bidder to execute Bids, stating that the material in the Escrow Bid Documents constitutes all the documentary information used in preparation of the Bid and that the Bidder has personally examined the contents of the Escrow Bid Documents container and has found that the documents in the container are complete.

BID DOCUMENTATION CERTIFICATION

THE UNDERSIGNED HEREBY CERTIFIES THAT THE BID DOCUMENTATION CONTAINED HEREIN CONSTITUTES ALL OF THE INFORMATION USED IN PREPARATION OF THE BID AND THAT I HAVE PERSONALLY EXAMINED THESE CONTENTS AND HAVE FOUND THAT THIS BID DOCUMENTATION IS COMPLETE.

SIGNATURE: _____

NAME: _____

TITLE: _____

FIRM: _____

DATE: _____

(3) Escrow Bid Documents of the apparent successful Bidder will be examined, organized and inventoried by representatives of the City, together with members of the Contractor's staff who are knowledgeable of how the Bid was prepared. This examination is to ensure that the Escrow Bid Documents are legible and complete. It will not constitute approval of proposed construction methods, estimating assumptions, or interpretations of Contract Documents. Examination will not alter any condition or term of the Contract.

(4) If all the documentation required in Section D, "Format and Contents", has not been included in the original submittal, additional documentation shall be submitted, at the City's sole discretion, within twenty four (24) hours after the original inventory and examination of the Escrow Bid Documents and prior to award of the Contract. The detailed breakdown of estimated costs shall be reconciled and revised, if appropriate, by agreement between the Contractor and the City before making the award. If the Contract is not awarded to the apparent successful Bidder, the Escrow Bid Documents of the Bidder next to be considered for award shall be processed as described above.

(5) Timely submission of complete Escrow Bid Documents is an essential element of the Bidder's responsiveness and a prerequisite to a Contract award. Failure to provide the necessary Escrow Bid Documents shall render the Bid non-responsive. Escrow Bid Documents of the unsuccessful Bidders will be returned, unopened, following award of the Contract.

(6) If any Bidder's Bid is based on subcontracting any part of the work, each Subcontractor, whose total subcontract price exceeds five percent (5%) of the total Contract price bid by the Bidder, shall provide separate Escrow Bid Documents to be included with those of the Bidder. Such documents shall be opened and examined in the same manner and at the same time as the examination described above for the apparent successful Bidder.

(7) If the Contractor wishes to subcontract any portion of the work after award, the City retains the right to require the Contractor to submit Escrow Bid Documents from the Subcontractor before the subcontract is approved.

F. Storage

The Escrow Bid Documents will be placed in escrow, for the life of the Contract, in a mutually agreeable institution. The cost of storage will be paid by the City.

G. Examination

(1) The Escrow Bid Documents shall be examined by both the City and the Contractor, at any time deemed necessary by either the City or the Contractor, to assist in the negotiation of price adjustments and Change Orders or the settlement of disputes and claims.

(2) Examination of the Escrow Bid Documents is subject to the following conditions:

a. As trade secrets, the Escrow Bid Documents are proprietary and confidential.

b. The City and the Contractor shall each designate, in writing to the other party and within ten (10) days after execution of the Contract, representatives who are authorized to examine the Escrow Bid Documents. No other person shall have access to the Escrow Bid Documents.

c. Access to the Escrow Bid Documents may take place only in the presence of duly designated representatives of both the City and the Contractor.

(3) The Escrow Bid Documents at all times remain the property of the Contractor and the City will take all reasonable steps necessary to protect confidentiality.

H. Final Disposition

(1) The Escrow Bid Documents will be returned to the Contractor at such time as the following conditions have been satisfied.

a. The Contract has been completed.

b. Final payment has been issued by the City.

c. All litigation has been completed, and a written agreement has been executed between the City and the Contractor that no further litigation will be made.

(2) The Escrow Bid Documents will be sealed and promptly returned to the Contractor by the party in charge of the Escrow Bid Documents. Reproduction of any portion of the Escrow Bid Documents will not be permitted at any time without the written permission of the Contractor.]

[10-7 PARTNERING]

[LAWA intends to encourage the foundation of a cooperative partnership with the Contractor and his subcontractors. To this goal, the successful bidder will have the opportunity to enter into a cooperative partnership agreement with LAWA for the contract. The objective of this Partnering agreement would be effective completion of the Work on time and to achieve a standard of quality that would be a source of pride to both LAWA and the Contractor. Partnering is intended only to establish an environment of cooperation between the parties and will not affect the terms of the contract.

The partnership will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. It will focus on good communication and creative cooperation to resolve problems in a timely, professional, and non-adversarial manner. The objective is to provide a quality project, safely, on time and within budget so that all are proud to contribute.

This partnership would be bilateral in makeup, and participation will be totally voluntary. Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally.

To implement this partnership initiative, at a mutually agreed date between both parties, a one day partnership development and team building workshop, to be attended by the Contractor's on-site staff, LAWA personnel, LAWA Design and Construction Management teams and other key agencies associated with the project will be held. The cost of this training, excluding staff labor charges, will be equally shared between Contractor and LAWA. Subsequent partnering sessions may be held, if agreed to by all partners

The City's share will be paid through a fixed cash allowance that has been allocated for the Opportunity to Partner and is included as an item of the Bid breakdown. Overhead and profit shall be as per Section 9.4, Allowances in the Special Provisions. However, if the Opportunity to Partner training funds are not expended, only partially expended, or over expended (only with the Engineer's prior approval), then an appropriate change order shall be executed in accordance with the provisions of Section 3-3 Extra Work.]

[10-8 CONSTRUCTION ENVIRONMENTAL MITIGATION REQUIREMENTS

10-8.1 GENERAL

This section covers construction related mitigation requirements as agreed to by the LAX Coalition and LAWA in connection with, and as a result of, the Community Benefits Agreement, effective date February 2005. This section consists of traffic mitigation measures, air quality construction related measures, restrictions on construction material stockpiles, and other miscellaneous items, as included hereafter.

The Contractor shall implement and comply with these requirements and standards in performing the work of this contract.

Compliance with this Section does not exempt the Contractor from compliance with other applicable permits, approvals, requirements, rules and regulations of other agencies with jurisdiction over the work of this contract.

Specific documents referenced in this section are available for review at the Engineer's Office.

10-8.2 TRAFFIC

The Contractor shall comply with the following traffic requirements:

A. Designated Haul Routes

The Contractor shall use the designated haul routes, as shown on the Contract Plans, for all construction traffic, deliveries, and employee travel. Haul routes shall be located away from residential areas. Construction trucks will not be allowed on:

a. 104th Street between Hawthorne Boulevard and Inglewood Avenue;

b. Inglewood Avenue between Century Boulevard and Imperial Highway; and

c. Lennox Boulevard between Hawthorne Boulevard and Inglewood Ave.

A fine of $1,000 per violation shall be assessed against the Contractor and his/her subcontractors/suppliers who are found in violation of the designated truck route, as shown on the Contract Plans.

10-8.3 ROCK-CRUSHING OPERATIONS AND CONSTRUCTION MATERIAL STOCKPILES

The Contractor shall submit a Contractor Recycling Plan (CRP) within 30 days from Notice to Proceed for approval by the Engineer. The Contractor Recycling Plan shall describe what materials will be recycled and how the recycling will be implemented. The CRP shall be approved by the Engineer prior to start of construction or demolition.

A. Rock-crushing Operations

To reduce impacts from emissions of fugitive dust, the Contractor shall locate rock-crushing operations, if any, in areas away from LAX-adjacent residential areas, as shown on the plans, and/or as approved by the Engineer.

B. Construction Material Stockpiles Locations and Maintenance

Stockpile locations shall be confined to the areas shown on the plans. Stockpile locations/staging areas shall be accessed by construction vehicles with minimal disruption to adjacent public streets.

The Contractor shall seal the surface of all stockpiles of rock and earth materials that are not being actively constructed or mined with a dust control product. Treatment may include water spray via irrigation systems, proprietary non-toxic crusting agents, anchored geotextile fabric or tarps, erosion control fabric, seeding, or other methods approved by the Engineer. The method employed shall be appropriate for the expected duration of, and the material in, the stockpile. Throughout the duration of the project, the Contractor will be required to maintain the dust control seal to meet the requirements of this section. The Contractor shall submit the proposed method of sealing the stockpile area to the Engineer for approval prior to its use. All costs of sealing, and maintaining, stockpile seals are considered incidental to the Environmental Mitigation pay item, and no additional payment will be made.

In addition, the Contractor shall use operational controls to reduce the dust potential of stockpiles. These operational controls may include, but are not limited to:

1) Locating stockpiles behind natural or manufactured windbreaks.
2) Locating the working area on the leeward side of the active piles.

3) Use stone ladders, telescopic chutes, stacker conveyors of other mechanical devices to limit the drop of fall and exposure to wind when the stockpile is being constructed.
4) Limiting the height of the stockpile.
5) Minimize vehicle traffic, and vehicle speeds, in and around stockpiles.
6) Add or remove material from the downwind portion of the storage pile.
7) Avoid steep sides or faces on stockpiles.

See other sections of the project specifications for more stockpile dust control requirements.

10-8.4 AIR QUALITY

Contractor shall make every effort to reduce air pollutant emissions from construction traffic and equipment both on and off the airport. This includes, but is not limited to, use of construction equipment with "cleaner burning diesel" fuel and exhaust emission controls. The Contractor shall use alternative fuel or low emission vehicles to the maximum extent practicable.

The Contractor shall prepare and submit to the Engineer for approval, within 30 days from Notice to Proceed, a list of all equipment to be used, including Sub-Contractors' equipment, necessary to complete the Work. Said list shall include equipment type, model, fuel source and emission characteristics. The equipment list shall be updated monthly and submitted to the Engineer. The Contractor shall ensure that equipment is in proper working order as to minimize harmful emissions.

The Contractor shall submit to the Engineer a monthly log showing daily fugitive dust mitigation measures. The log shall specify the subject area, mitigation measures utilized, frequency of control and other relevant information.

All diesel equipment used for construction shall be outfitted with the Best Available Control Technology (BACT) devices certified by the California Air Resources Board (CARB - see www.carb.gov). These devices shall primarily reduce diesel emissions of Particulate Matter (PM), including fine PM, and secondarily, reduce emission of NOx. This requirement shall apply to diesel powered off-road equipment (such as construction machinery), on-road equipment (such as trucks), and stationary diesel engines (such as generators). The BACT device shall be approved by CARB as specified on the website. A copy of each unit's certified BACT documentation, and each unit's CARB or SCAQMD operating permit, shall be provided at the time of mobilization of each applicable unit of equipment. This requirement applies diesel equipment owned and/or operated by the Prime Contractor and Sub-Contractors.

Any emission control devise used by the Contractor shall achieve emission reduction no less than what could be achieved by a Level 2 diesel emission control strategy for a similar-sized engine as defined by CARB regulations.

An exemption to the above may be warranted for a piece of construction-related diesel equipment for which the operator provides a written finding, based upon appropriate market research and approved by the Engineer, that the best available emission control device for reducing the emissions of pollutants is unavailable for that equipment. In such case, the Contractor shall use other technology for reducing the emission of pollutants, if any is available and appropriate for that vehicle, and as deemed appropriate by the Engineer.

Heavy duty and medium-heavy duty vehicles equipment for the Work that are subject to the CARB Voluntary Software Upgrade Program shall have the low NOx Rebuild Software installed. Subject vehicles are model year 1993-1999 with electronically controlled diesel engines manufactured by Caterpillar, Cummins, Detroit Diesel, International, Mack/Renault and Volvo. Documentation of this software upgrade shall be submitted at time of mobilization or before vehicles are utilized.

Under no circumstances shall an emission reduction device or strategy used on the construction site increase the emission of any pollutant above that which is the standard for that engine.

A. Non-Road Mobile Source Controls

1. The Contractor shall prohibit staging or parking of construction vehicles (including workers' vehicles) on streets adjacent to schools, daycare centers, and hospitals.

2. The Contractor shall prohibit construction diesel vehicles or equipment from idling in excess of the idling restrictions as defined in CARB Vehicle Idling Rule. The Contractor shall advise drivers and operators of these requirements at the pre-construction orientation meeting, remind them on a daily basis, and post signs in appropriate places indicating the CARB Vehicle Idling Rule. Exemptions may be granted for safety-related and operational reasons, as defined in CARB or as approved by the Engineer. The Contractor and subcontractors shall have policies and procedures in place for compliance with the Vehicle Idling Rule and a copy of such shall be submitted within 30 days of Notice to Proceed to the Engineer for approval.

3. Whenever possible, the Contractor shall utilize on-site rock crushing facility during construction to reuse rock/concrete and minimize off-site truck haul trips.

B. Stationary Point Source Controls

The Contractor shall specify a combination of electricity from power poles and electricity from portable diesel- or gasoline-fueled generators using "cleaner burning diesel" fuel and exhaust emission controls for his electrical energy requirements.

1. The Contractor shall obtain approval of the Engineer for the use of internal combustion engine water pumps, power generators, air compressors and other related construction equipment when an option exists to utilize grid power or electric powered equipment.

2. In accordance with SCAQMD Rule 431.2, all diesel construction equipment shall use only Ultra Low Sulfur Diesel fuel (15 ppm or lower), so long as there are adequate supplies of ULSD in the Southern California area. If adequate supplies of ULSD are not available in the Southern California area, then other fuels may be used, provided that the other fuels do not result in emission of fine PM or nitrogen oxides greater than that which would be produced by use of ULSD at 15 ppm or lower. Cost of ULSD shall not be a consideration in determining "adequate supplies". Contractor shall maintain records of diesel fuel procurement for inspection by the Engineer. Diesel fuel samples will be taken periodically by the Engineer and analyzed by an independent laboratory.

3. No emission control device shall increase the emission of any pollutant above that which is the standard for that engine.

10-8.5 COMPLIANCE AND ENFORCEMENT

It is the Contractor's responsibility to be in compliance with all the requirements in these specifications. The Contractor shall provide to the Engineer a monthly summary status report of compliance of these specifications. The Engineer will randomly monitor the Contractor's compliance with mitigation requirements throughout the term of the Contract.

The Engineer retains the authority to assess penalties for non-compliance. These penalties will be of $1,000 per day and per occurrence for each non-compliance of the specified requirements herein as deemed by the Engineer.

All contractors' records related to the implementation of these construction related measures are subject to a Third Party Monitor review and LAWA audit at any time, and for the duration of the contract.

10-8.6 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

[No separate payment will be made for construction environmental mitigation services which shall be considered incidental to other bid items].

[Payment will be made at the contract lump sum price for "Environmental Mitigation Requirements", which price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to comply with the requirements set forth in this Section.]

[10-9 OTHER REQUIREMENTS]

[Description]

BASIS OF PAYMENT

Payment will be made under:

Item 10.1	Document Control Services	per Allowance
Item 10.2	**[Opportunity to Partner][Other]**	per Allowance
[Item 10.3	Environmental Mitigation Requirements	per lump sum]

END OF SECTION 10

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SECTION 11 – SEQUENCING OF CONSTRUCTION

11-1 GENERAL

The Contractor shall perform all work in accordance with the construction sequencing plans as shown on the plans and as described herein. The plans and descriptions are intended to give a general outline of the order in which the work is to be accomplished, and to set forth operating restrictions which will be in effect for each Work Area. Neither the sequencing plans, nor the descriptions contained in this section, are intended to be a comprehensive list of work items. It is the Contractor's responsibility to anticipate upcoming work and to coordinate his operations and schedule accordingly to ensure a timely flow of construction operations. The Contractor's schedule shall be submitted to the Engineer prior to commencement of construction as required under Sections 6, and 19 of the Specifications. The Contractor's Schedule shall be based upon furnishing sufficient labor, equipment, and materials that will allow all work to be completed within the contract time limit.

The Contractor shall closely coordinate and schedule work with other Contractors completing work on the airfield. Prior to preparing the construction schedule and regularly during the construction, the Contractor shall meet with the LAWA Engineer to discuss other work occurring on the airfield. The Contractor shall incorporate into the construction schedule any required restrictions or dates required to make sure that no conflicts with other Contractors occur.

[The Engineer will issue an individual Notice to Proceed for each Work Area as described hereafter and a separate Notice to Proceed will be issued for construction within a fuel line right of way. Before the Contractor may begin any work in a given Work Area, he shall request, in writing, that the Engineer issue the NTP for that Work Area/ right of way.]

The Contractor shall perform improvements within each Work Area in the order presented in this section, and shall complete each Work Area within the periods of time specified. Included in the Work Area time allotment is the cure time for any epoxy, paints, cement, etc. required for approval by the Engineer. As described below, some Work Areas shall be completed and inspected by the Engineer prior to commencement of other phases of work. Liquidated damages in the amounts specified in Section 6 shall be assessed if the Contractor fails to complete all Work Areas within the specified allowable duration.

The words "Work Area" are used hereafter to describe either the period of time, and/or the area in which certain work is to be done. These are indicated on the plans and herein with alpha-numeric labels. The most demanding operational restrictions or closures of adjacent taxiways and runways, as outlined below for each Work Area, shall apply regardless of other concurrent work in progress. For instance, if work in Area ABC requires closure of Twy XX and work in Area XYZ allows Twy XX to remain open, simultaneous work by the Contractor in both Areas ABC and XYZ will require the closure of Twy XX. The term "Predecessor" used in the descriptions below identifies Work Areas for which all work must be completed, beneficial occupancy granted, and in some cases, the area opened to aircraft traffic before work in the Work Area under discussion can begin. The term "Successor" used in the descriptions below identifies

Work Areas for which no work may begin until all work in the Work Area under discussion has been completed, beneficial occupancy granted, and the area opened to aircraft traffic.

11-2 PROJECT SEQUENCING

11-2.1 Work within Work Area Limit Lines

The limits of work for each Area of construction are clearly shown on the construction sequencing plans, indicating offset distances from adjacent active runways and/or taxiways. For each Work Area, these lines show the limit of the work area in which the Contractor may have workers, equipment, and materials, and in which he may conduct work for that area. In no circumstance will work be allowed to take place within **[250]** feet of active runway centerlines, or within **[125]** feet of active taxiway centerlines. Limit lines shown on the plans are often larger than these minimums, in which cases the limits shown on the plans shall control.

In daytime work areas, the Contractor shall maintain conditions for Runway Safety Areas (RSAs) in all areas within **[250]** feet of an active runway centerline. Conditions to be maintained in these areas are the design standards for Runway Safety Areas listed in FAA Advisory Circular, 150/5300-13, Paragraph 305, which reads:

A. Design Standards

The runway safety area shall be:

(1) "Cleared and graded and have no potentially hazardous ruts, humps, depressions or other surface variations;

(2) Drained by grading or storm sewers to prevent water accumulation;

(3) Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and

(4) Free of objects, except for objects that need to be located in the runway safety area because of their function. Objects higher than 3 inches above grade should be constructed on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches above grade. Other objects such as manholes should be constructed at grade. In no case should their height exceed 3 inches above grade."

The Engineer shall retain the right to shut down Contractor operations in any Work Area if these conditions are not being met.

11-2.2 Operations

The Contractor shall conduct all his operations in such a manner so as to maintain a smooth, safe, uninterrupted flow of aircraft and vehicular traffic adjacent to the work site. The construction staging sequence and schedule shown on the plans has been developed to minimize the impact of construction activities on airfield operations.

The Contractor shall conduct all his earthwork construction in such a manner so as to minimize any potential differential settlement between the edges of two adjacent construction phases. He shall also ensure that runway and taxiway safety areas adjacent to active aircraft operations are in conformance with FAA standards at all times. At the Contractor's own cost, temporary precast panels, steel plating, shotcrete, gabions, engineering fabric or other approved methods can be applied at limited locations in order to satisfy these requirements. See Section 37 of these Specifications for specific criteria. Any such method must receive advance approval of the Engineer prior to its use on the project.

Work Areas that are not under construction shall be accessible and operational at all time.

Limits of the various Work Areas shall be clearly delineated with barricades, warning signs; barricade lights and other markings as shown on the plans and specified herein, in order to deter aircraft and vehicles from entering the construction areas. The Contractor shall work closely with Airport Operations personnel and the Engineer to ensure that the work is accomplished with minimal interference to aircraft movements.

Elements of the various Work Areas as shown on the Construction Sequencing Plans shall be constructed in accordance with the schedule and sequence outlined on the plans and in this Section. The "Duration" period shown in each schedule is the maximum time allowed for completion of each Work Area. Mobilization will be the first work activity the Contractor will be required to perform under the contract prior to beginning any Work Area as outlined below. See Section 16 of these specifications for a list of work tasks considered necessary for completion of Mobilization.

The Contractor shall note that the alpha-numeric numbering of the Work Area *does not* imply ordering (i.e., construction of Part B of any particular Work Area may not necessarily follow part A; Part 2 may not necessarily follow Part 1, etc. Contractor is advised to review the schedule given and to note the necessary predecessors and successors to each Work Area).

The Contractor shall maintain power supply for all runway and taxiway lighting systems at all times, unless otherwise specified. When temporary bypasses of active lines are to be constructed in order to work on portions of the circuits, the circuits shall be de-energized and re-energized in conformance with the procedures specified these Specifications.

For all work in Daytime Work Areas, the Contractor shall use one 10-hour work shifts each and every day, except Sundays and holidays, when no work shall be done. Barricade lighting and flagging, and temporary taxiway closure markings shall be erected and maintained around the perimeter of all Daytime Work Areas at all times, as shown on the plans.

Work within the Nighttime Work Areas shall be performed within the allowed times noted for each specific Work Area in Section 11-4. Barricade lighting must be placed at the locations shown on the plans and taxiway closure markings as directed by the Engineer, at the beginning of each Nighttime Work shift, and shall be removed at the conclusion of each shift.

Work within the Weekend or other Limited-time Work Areas shall be performed within the allowed times noted for each specific Work Area in Section 11-4. Barricade lighting must be placed at the locations shown on the plans and taxiway closure markings as directed by the Engineer, at the beginning of each Weekend or other Limited-time Work shift, and shall be removed at the conclusion of each shift.

[Figure 11.1, and the end of this Specification, shows a sequencing chart of the various Phases and Work Areas as they relate to each other and to the overall project duration.]

11-3 OPENING SECTIONS OF THE WORK TO TRAFFIC

11-3.1 Completion of Work Areas

The Contract work on this project will be accepted for beneficial occupancy on a Work Area basis. Each Work Area of the work as specified hereafter, and as shown on the plans, shall be completed within the period of time specified. As each Work Area is completed, the Contractor shall request, in writing, that the Engineer accept beneficial occupancy of that portion of the work. If the Engineer deems the work to be complete, a written notice of substantial completion and acceptance for beneficial occupancy will be given and the calculation of liquidated damages for that portion of the work will cease. If the Engineer deems that additional work is required on that work area, but still accepts beneficial occupancy, contractor will be required to schedule with the Engineer on the work hours to complete the final items on the work area.

11-3.2 Daily Inspection at Completion of Work Shift

Some areas of nighttime, weekend or other limited-time construction require the Contractor to construct new pavement in an incremental manner so that aircraft operations may resume over the area under construction during daytime hours. Construction in these areas will necessitate the use of innovative pavement construction techniques to provide temporary load-bearing pavements to safely support taxiing aircraft between work shifts. See Section 37 of these specifications for details. For those areas that will be opened to aircraft traffic during off-construction hours, steel plating may be required prior to opening these work areas to aircraft traffic to satisfy the airfield safety requirements listed in these specifications. Construction in these areas includes the extension of electrical services, including construction of new electrical in-pavement and edge lighting and signs, including, in some locations, concrete duct-bank crossings of taxiways. Prior to the completion of a work shift in which the work area will be opened to aircraft traffic, the area must be properly cleaned to remove all FOD and electrical edge lights (temporary or permanent) must be placed and operational.

It will be the Contractor's sole responsibility to develop a method of construction which will satisfy both the technical and scheduling requirements of the project and no extensions to the schedule will be allowed due to the difficulties of constructing under the short construction windows allowed. All extra costs for the work in these areas will be considered to be included in the Contractor's unit bid prices for the various items of work.

At the conclusion of each nighttime, weekend or other limited-time work shift in areas that are scheduled to be reopened to aircraft traffic each morning, the Engineer or Inspector will conduct a morning inspection of each of construction area before the Contractor's workers leave that work area for the day, and before the Contractor can be relieved of liquidated damages assessment for delays to runway or taxiway opening times for that night's work shift. This inspection is to ensure that the site is safe for aircraft operations. All areas within **[250]** feet of the runway centerline, within **[125]** feet of active taxiway centerlines shall satisfy the conditions described below before opening to aircraft traffic.

Conditions which Inspectors will consider potentially hazardous, and which must be corrected prior to reopening the runways and taxiways each morning, are listed in Section **[10-3.9]** of these Specifications.

11-3.3 Changes to Sequencing Plans

The sequence of work as outlined in this section, and on the plans, has been developed to provide the best flow of construction operations for the project. Due to other on-going projects on the airfield, however, it may be necessary at the time of construction to reorder the sequence of some work in order to minimize overall operational impacts on the airport which may be caused by delays or schedule changes on other projects. LAWA therefore retains the option of modifying the sequence or work as set forth herein, without penalty, if necessary. Such changes, should they occur, are anticipated to place entire blocks of work in a different order (Work Area 2 prior to Work Area 1, for example) as opposed to reordering individual components of individual work areas. The Contractor will be given all possible advance notification of any such required changes to the construction sequencing.

11-3.4 Pre-work Requirements

(1) Contractor Mobilization

(2) Setup Contractor's staging area**[, including concrete batch plant(s) and material crushing equipment].**

(3) Relocation of **[ ].**

(4) Obtain all required permits.

(5) Preparation of required submittals in accordance with the project specifications,

(6) [Pre-Demolition Work].

(7) **[Test Strip(s)].**

(8) **[Procurement and transport of long lead construction materials to the job site].**

(9) **[Temporary lighting and other lighting work required to maintain and operational airfield].**

(10) **[Install barricades, flag lines and fences as depicted in the construction drawings].**

(11) **[Fiber Optic and Power System rerouting required to maintain the airfield operation].**

(12) **[Haul route improvements].**

(13) **[Other].**

11-3.5 Unscheduled Closures

Minimizing the effects of construction activities on airfield operations is of paramount importance. The Contractor will be expected to accomplish all work within the allowed time periods within each Work Area as stated. Should any unscheduled closures of a runway or taxiway be necessitated by the Contractor's negligence, Liquidated Damages in the amount set forth in Section 6-9 of these specifications will be assessed.

11-4 CONSTRUCTION SEQUENCING

11-4.1 [Daytime] [Nightime] Work Area [1A]:

A. Description: Daytime Work Area [1A]:

Construction of all improvements within Work Area [1A] as shown on the plans and described herein.

B. Work to be done in Work Area [1A]:

All work called for on the plans to accomplish the following:

(1) Placement of barricades and temporary lighting required to delineate the work areas and to maintain a safe separation of aircraft and construction operating areas.

(2) Temporary marking and marking removals shall be the first work to occur in work areas after placement of barricades and temporary lighting.

(3) Demolition of existing **[airfield lighting and signage; other miscellaneous utilities/items]** shown on the plans and scheduled for demolition.

(4) Construction/Modification of **[airfield pavements; airfield lighting and signage; storm drain lines and appurtenances; other underground utilities improvements]** shown on the plans.

(5) **[Installation of closure markers for Runway [ ] prior to beginning work]every night.]**

(6) **[Taxiway closure markings shall be removed and permanent marking installed upon completion of other improvements in each work area.]**

C. Airfield pavement areas to be closed during construction of Work Area [1A]:

(1) For Work Area 1A: Close Runway **[ ]**; portions of Taxiways **[ ]**.

D. Airfield pavement areas to remain open during construction of Work Area [1A]:

[List nearby pavement areas to remain open][All other operating surfaces shall remain open].

E. Other Conditions for Work Area [1A]:

(1) The airfield electrical lights and circuits will be phased by the Contractor to match the pavement areas that are open and closed during all of the phases.

(2) Contractor shall work **[ ]** days a week – **[p.m.]** to **[a.m.]** for nighttime areas and **[ ]** days a week and a minimum of one **[ ]**-hour shift per day for the day-time work areas.

(3) Any work on Taxiways to remain open, including, but not limited to, striping removal, or any work within **[250]** feet of active Runways, shall be coordinated with the Engineer and will only be allowed during the time period of **[p.m.]** to **[a.m.].**

(4) All utilities within and passing through the work area shall be kept operational at all times, unless otherwise specified.

(5) Contractor shall install and maintain barricade lights, flags and closed taxiway markers as shown on the plans and as directed by the Engineer during work shift hours. **[Closure lights and markers shall be removed at the end of the shift immediately prior to reopening the pavement areas.]**

(6) **[Contractor shall take extra care to ensure that service roads shown on the plans are maintained, remain open and/or are rerouted to remain open during construction.]**

(7) **[At the conclusion of work shifts, areas shall satisfy the requirements in Section 11-3.2, before pavement can be opened to aircraft traffic, and before the Contractor can be relieved of liquidated damages for that shift.]**

F. Predecessors to Work Area [1A]: [Mobilization] [Work Area]

G. Successors to Work Area [1A]: [Work Area]

11-4.2 [Daytime] [Nightime] Work Area [ ]:

[Provide specific details for A-G above for all subsequent phases and/or subphases of Work]

11-5 MEASUREMENT AND PAYMENT

Sequencing of the work as described herein will not be measured for payment. The Contractor shall make his own estimate of the inherent difficulties involved in completing the work under the conditions stated and shall not claim any added compensation by reason of delay or increased costs due to opening a portion of the contract work or for difficulties or costs associated with other staging considerations.

[INSERT FIGURE 1-1 GANTT DIAGRAM]

END OF SECTION 11

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SECTION 12 – CONTRACTOR QUALITY CONTROL PROGRAM (FAA 100)

12-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for providing a Contractor Quality Control Program in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Section 100, as included and modified hereafter, and as shown on the Plans.

SECTION 100
CONTRACTOR QUALITY CONTROL PROGRAM

100-01 GENERAL. *When the specification requires a Contractor Quality Control Program, the Contractor shall establish, provide, and maintain an effective Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.*

The intent of this section is to enable the Contractor to establish a necessary level of control that will:

a. *Adequately provide for the production of acceptable quality materials.*

b. *Provide sufficient information to assure both the Contractor and the Engineer that the specification requirements can be met.*

c. *Allow the Contractor as much latitude as possible to develop his or her own standard of control.*

The Contractor shall be prepared to discuss and present, at the preconstruction conference, his/her understanding of the quality control requirements. The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed by the Engineer. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been reviewed.

The quality control requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the

acceptance testing requirements. Acceptance testing requirements are the responsibility of the Engineer.

100-02 DESCRIPTION OF PROGRAM.

a. General Description. *The Contractor shall establish a Quality Control Program to perform inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. This Quality Control Program shall ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.*

b. Quality Control Program. *The Contractor shall describe the Quality Control Program in a written document that shall be reviewed by the Engineer prior to the start of any production, construction, or off-site fabrication. The written Quality Control Program shall be submitted to the Engineer for review at least 7 calendar days before the pre-construction conference.*

The Quality Control Program shall be organized to address, as a minimum, the following items:

1. *Quality control organization;*

2. *Project progress schedule;*

3. *Submittals schedule;*

4. *Inspection requirements;*

5. *Quality control testing plan;*

6. *Documentation of quality control activities; and*

7. *Requirements for corrective action when quality control and/or acceptance criteria are not met.*

The Contractor is encouraged to add any additional elements to the Quality Control Program that he/she deems necessary to adequately control all production and/or construction processes required by this contract.

100-03 QUALITY CONTROL ORGANIZATION. *The Contractor Quality Control Program shall be implemented by the establishment of a separate quality control organization. An organizational chart shall be developed to show all quality control personnel and how these personnel integrate with other management/production and construction functions and personnel.*

The organizational chart shall identify all quality control staff by name and function, and shall indicate the total staff required to implement all elements of the Quality Control Program, including inspection and testing for each item of work. If necessary, different technicians can be utilized for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the Quality Control Program, the personnel assigned shall be subject to the qualification requirements of paragraph 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The quality control organization shall consist of the following minimum personnel:

a. Program Administrator. *The Program Administrator shall be a full-time employee of the Contractor, or a consultant engaged by the Contractor. The Program Administrator shall have a minimum of 5 years of experience in airport and/or highway construction and shall have had prior quality control experience on a project of comparable size and scope as the contract.*

Professional licenses and certificates along with four (4) references shall be provided for work on projects completed within the past ten (10) years. Resumes must be submitted for review and approval for the proposed Program Administrator(s).

Additional qualifications for the Program Administrator shall include at least 1 of the following requirements:

(1) *Licensed Professional Civil Engineer with five (5) years of airport grading and drainage, field and laboratory testing, and Quality Control experience acceptable to the Engineer.*

(2) *A certified Engineer-in-Training with eight (8) years experience in airport grading and drainage, field and laboratory testing, and quality control experience acceptable to the Engineer.*

(3) *An individual with thirteen (13) years of airport paving experience acceptable to the Engineer and Certified at NICET level IV in an approved field.*

(4) *Construction materials technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).*

(5) *Highway materials technician certified at Level III by NICET.*

(6) *Highway construction technician certified at Level III by NICET.*

(7) *A NICET certified engineering technician in Civil Engineering Technology with 5 years of highway and/or airport paving experience acceptable to the Engineer*

The Program Administrator shall have full authority to institute any and all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical specifications. The Program Administrator will fully cooperate and will work closely with the Construction Manager and LAWA to implement adjustments as needed to the Quality Control Program, and to the adjustments to the number of Quality Control Technicians and Inspectors. The Program Administrator's sole responsibility shall be restricted to the supervision, and implementation the Contractor's Quality Control Program.

***b. Quality Control Technicians and Inspectors**. A sufficient number of quality control technicians necessary to adequately implement the Quality Control Program shall be provided. These personnel shall be either engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II or higher construction materials technician or highway construction technician and shall have a minimum of four (4) years of experience in their area of expertise.*

Certification at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification. The Quality Control technicians and inspectors shall report directly to the Program Administrator and shall perform the following functions:

***(1)** Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by Section 100-06.*

(2) *Performance of all quality control tests as required by the technical specifications and Section 100-07.*

Certification at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

c. Staffing Levels. *The Contractor shall provide sufficient qualified quality control personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The Quality Control Program shall state where different technicians will be required for different work elements.*

A testing and inspection technician is required at all times that any work is being performed by the prime contractor, and any subcontractor. If a construction activity is found to have an unacceptable level of quality control technicians or inspectors, the activity may be suspended until an approved level of quality control directed is provided. LAWA may also elect to place their quality acceptance personnel in the quality control role in lieu of suspending the work. In this event, the Contractor will be notified immediately. LAWA will track their time and materials, and all costs associated with this will be deducted from the Contractors earned amounts.

Each week the Contractor shall submit to the Engineer, the number of Quality Control technicians and inspectors anticipated for the following two (2) weeks for each work activity. The Engineer shall review the number of Quality Control personnel required for the work.

d. Minimum Testing Equipment*. The Quality Control Technicians shall be equipped with, but not limited to the following test equipment:*

1. *Calibrated Sand cone equipment (sand cone, jar, plate, and calibrated sand.)*
2. *Calibrated Speedy Moisture Gauges with Reagents.*
3. *Calibrated scales (No. 4 and ¾-inch screens for rock percentage).*
4. *Equipment to dig sand cone holes. (large spoon, screwdriver, soft brush and hammer).*
5. *Concrete testing equipment meeting required specifications (slump cone, slump plate, 5/8"-inch diameter rod, 3/8-inch diameter rod a large and a small scoop).*
6. *One Point Proctor Equipment. (4-inch diameter mold, 5-pound and 10-pound proctor hammer and a family of curves chart).*
7. *Wheel Barrows.*
8. *Shovels.*

9. *Sample bags and buckets.*
10. *Calibrated Nuclear Density Gauges.*
11. *Voltmeter, ampere meter and meters to identify live electrical circuits.*

100-04 PROJECT PROGRESS SCHEDULE. *See specification Section 19, Contractor's Construction Schedule and Reports.*

100-05 SUBMITTALS SCHEDULE. *See Standard Specifications.*

100-06 INSPECTION REQUIREMENTS. *Quality control inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by Section 100-08.*

Prior to the start of construction work under each separate specification section, where a change in construction operation is contemplated by the Contractor, and prior to a new subcontractor starting work, a coordination meeting will be held with the Engineer, Quality Control Administrator COLA, and LAWA. Other attendance shall include supervisory, safety and Quality Control representatives of all applicable subcontractors. The Engineer will chair the meeting. The purpose of the meeting is to ensure the Contractor's personnel have no misunderstandings regarding the Quality Control procedures as well as the technical requirements of the Contract. The following items shall be presented during the meeting.

a. *Inspections shall be performed daily to ensure continuing compliance with contract requirements until completion of the particular feature of work. These shall include the following minimum requirements:*

1. *Contract requirements and specifications.*
2. *Shop drawings, certifications, submittals and as-built drawings that may apply.*
3. *Testing and inspection program and procedures.*
4. *Contractor's Quality Control Program.*
5. *Familiarity and proficiency of the contractor's and subcontractor's work force to perform the operation to the required workmanship standards.*
6. *Safety and Aircraft Operational Area restrictions to be observed.*
7. *Any other preparatory steps dependent on the particular operation.*
8. *The Contractor's means and methods for performing the work.*

b. Inspections shall be performed continuously during each prime contractor and subcontractor work shifts to ensure continuing compliance with contract requirements until completion of the particular feature of work. These inspections shall include the following minimum requirements:

b. During plant operation for material production, quality control test results and periodic inspections shall be utilized to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment utilized in proportioning and mixing shall be inspected to ensure its proper operating condition. The Quality Control Program shall detail how these and other quality control functions will be accomplished and utilized.

***c.** During field operations, quality control test results and periodic inspections shall be utilized to ensure the quality of all materials and workmanship. All equipment utilized in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The Program shall document how these and other quality control functions will be accomplished and utilized.*

***100-07 QUALITY CONTROL TESTING PLAN.** As a part of the overall Quality Control Program, the Contractor shall implement a quality control testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.*

The testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

- ***a.*** *Specification item number (e.g., P-401);*
- ***b.*** *Item description (e.g., Plant Mix Bituminous Pavements);*
- ***c.*** *Test type (e.g., gradation, grade, asphalt content);*
- ***d.*** *Test standard (e.g., ASTM or AASHTO test number, as applicable);*
- ***e.*** *Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated);*
- ***f.*** *Responsibility (e.g., plant technician); and*
- ***g.*** *Control requirements (e.g., target, permissible deviations).*
- ***h.*** *The staff required to complete the tests.*

The testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D 3665. The Engineer shall be provided the opportunity to witness quality control sampling and testing.

All quality control test results shall be documented by the Contractor as required by Section 100-08.

100-08 DOCUMENTATION. *The Contractor shall maintain current quality control records of all inspections and tests performed. These records shall include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.*

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Engineer daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the Contractor's Program Administrator.

Specific Contractor quality control records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily Inspection Reports. *Each Contractor quality control technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations on a form acceptable to the Engineer. These technician's daily reports shall provide factual evidence that continuous quality control inspections have been performed and shall, as a minimum, include the following:*

(1) *Technical specification item number and description;*
(2) *Compliance with approved submittals;*
(3) *Proper storage of materials and equipment;*
(4) *Proper operation of all equipment;*
(5) *Adherence to plans and technical specifications;*
(6) *Review of quality control tests; and*
(7) *Safety inspection.*

The daily inspection reports shall identify the type of operation or activity, equipment utilized, location by station and offset, inspections conducted, times and results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the Quality Control technician and the Program Administrator. The Engineer shall be provided with one (I) legible copy of each inspection report for each shift, on the work day following the shift of record.

b. Daily Test Reports. *The Contractor shall be responsible for establishing a system that will record all quality control test results. Daily test reports shall document the following information:*

(1) *Technical specification item number and description;*
(2) *Test designation;*
(3) *Location;*
(4) *Date of test;*
(5) *Control requirements;*
(6) *Test results;*
(7) *Causes for rejection;*
(8) *Recommended remedial actions; and*
(9) *Retests.*

Test results from each day's work period shall be submitted to the Engineer prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical quality control charts. The daily test reports shall be signed by the responsible quality control technician and the Program Administrator.

100-09 CORRECTIVE ACTION REQUIREMENTS. *The Quality Control Program shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.*

The Quality Control Program shall detail how the results of quality control inspections and tests will be used for determining the need for corrective action and shall contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and utilize statistical quality control charts for individual quality control tests. The requirements for corrective action shall be linked to the control charts.

100-10 SURVEILLANCE BY THE ENGINEER. *All items of material and equipment shall be subject to surveillance by the Engineer at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed herein and the applicable technical specifications and plans. In addition, all items of materials, equipment and work*

in place shall be subject to surveillance by the Engineer at the site for the same purpose.

Surveillance by the Engineer does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor's or subcontractor's work.

100-11 NONCOMPLIANCE.

a. Notification. *The Engineer will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Any notice, when delivered by the Engineer or his authorized representative to the Contractor or his authorized representative at the site of the work, shall be considered sufficient notice.*

b. Noncompliance*. In cases where Quality Control activities do not comply with either the Contractor's Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the Engineer and LAWA, the Engineer or LAWA may:*

(1) *Order the Contractor to replace ineffective or unqualified quality control personnel or subcontractors.*

(2) *Order the Contractor to stop operations until appropriate corrective actions is taken.*

(3) *Elect to place Quality Acceptance personnel in the quality control role in lieu of suspending the work and charge the Contractor .*

END OF SECTION 100

12-2 METHOD OF MEASUREMENT

All costs associated with work described in this section shall be considered incidental to other bid items, and there shall be no separate payment.

12-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for trenching, bare counterpoise wire and duct bank or conduit, installed by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item

END OF SECTION 12

SECTION 13 – METHOD OF DETERMINING PERCENTAGE WITHIN LIMITS (FAA 110)

13-1 GENERAL

This section describes the Method of Determining the Percentage Within Limits (PWL) used to calculate adjusted pay factors for pavement. PWL determination shall be made in accordance with the FAA Standard Specification 110 as follows:

SECTION 110 – METHOD OF ESTIMATING PERCENTAGE OF MATERIAL WITHIN SPECIFICATION LIMITS (PWL)

110-1.1 GENERAL. *When the specifications provide for acceptance of material based on the method of estimating percentage of material within specification limits (PWL), the PWL will be determined in accordance with this section. All test results for a lot will be analyzed statistically to determine the total estimated percent of the lot that is within specification limits. The PWL is computed using the sample average (X) and sample standard deviation (S_n) of the specified number (n) of sublots for the lot and the specification tolerance limits, L for lower and U for upper, for the particular acceptance parameter. From these values, the respective Quality index(s), Q_L for Lower Quality Index and/or Q_U for Upper Quality Index, is computed and the PWL for the lot for the specified n is determined from Table 1.*

There is some degree of uncertainty (risk) in the measurement for acceptance because only a small fraction of production material (the population) is sampled and tested. This uncertainty exists because all portions of the production material have the same probability to be randomly sampled. The Contractor's risk is the probability that material produced at the acceptable quality level is rejected or subjected to a pay adjustment. The Owner's risk is the probability that material produced at the rejectable quality level is accepted.

It is the intent of this section to inform the Contractor that, in order to consistently offset the Contractor's risk for material evaluated, production quality (using population average and population standard deviation) must be maintained at the acceptable quality specified or higher. In all cases, it is the responsibility of the Contractor to produce at quality levels that will meet the specified acceptance criteria when sampled and tested at the frequencies specified.

110-1.2 METHOD FOR COMPUTING PWL. *The computational sequence for computing PWL is as follows:*

a. *Divide the lot into n sublots in accordance with the acceptance requirements of the specification.*

b. *Locate the random sampling position within the sublot in accordance with the requirements of the specification.*

c. *Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.*

d. *Find the sample average (X) for all sublot values within the lot by using the following formula:*

$X = (x_1 + x_2 + x_3 + \ldots x_n) / n$

Where: X = *Sample average of all sublot values within a lot*
x_1, x_2 = *Individual sublot values*
n = *Number of sublots*

e. *Find the sample standard deviation (Sn) by use of the following formula:*

$S_n = [(d_1^2 + d_2^2 + d_3^2 + \ldots d_n^2)/(n-1)]^{1/2}$

Where:

S_n = *Sample standard deviation of the number of sublot values in the set*

$d_1, d_2, \ldots$ = *Deviations of the individual sublot values $x_1, x_2, \ldots$ from the average value X that is: $d_1 = (x_1 - X)$, $d_2 = (x_2 - X) \ldots d_n = (x_n - X)$*

n = *Number of sublots*

f. *For single sided specification limits (i.e., L only), compute the Lower Quality Index Q_L by use of the following formula:*

$Q_L = (X - L) / S_n$

Where: L = *specification lower tolerance limit*

Estimate the percentage of material within limits (PWL) by entering Table 1 with Q_L, using the column appropriate to the total number (n) of measurements. If the value of Q_L falls between values shown on the table, use the next higher value of PWL.

g. *For double sided specification limits (i.e., L and U), compute the Quality Indexes Q_L and Q_U by use of the following formulas:*

$Q_L = (X - L) / Sn$ *and* $Q_U = (U - X) / Sn$

Where: L *and* U = *specification lower and upper tolerance limits*

Estimate the percentage of material between the lower (L) and upper (U) tolerance limits (PWL) by entering Table 1 separately with Q_L and Q_U, using the column appropriate to the total number (n) of measurements, and determining the percent of material above P_L and percent of material below P_U for each tolerance limit. If the values of Q_L fall between values shown on the table, use the next higher value of P_L or P_U. Determine the PWL by use of the following formula:

$PWL = (P_U + P_L) - 100$

Where: P_L = *percent within lower specification limit*
P_U = *percent within upper specification limit*

EXAMPLE OF PWL CALCULATION

Project: *Example Project*
Test Item: *Item P-401, Lot A.*

a. Determination for Mat Density

(1) Density of four random cores taken from Lot A.

A-1 96.60
A-2 97.55
A-3 99.30
A-4 98.35

$n = 4$

(2) Calculate average density for the lot.

$X = (x1 + x2 + x3 + . . xn) / n$
$X = (96.60 + 97.55 + 99.30 + 98.35) / 4$
$X = 97.95$ *percent density*

(3) Calculate the standard deviation for the lot.

$$Sn = [((96.60 - 97.95)^2 + (97.55 - 97.95)^2 + (99.30 - 97.95)^2 + (98.35 - 97.95)^2)) / (4 - 1)]^{1/2}$$
$Sn = [(1.82 + 0.16 + 1.82 + 0.16) / 3]^{1/2}$
$Sn = 1.15$

(4) Calculate the Lower Quality Index Q_L for the lot (L = 96.3).

$Q_L = (X - L) / Sn$
$Q_L = (97.95 - 96.30) / 1.15$
$Q_L = 1.4348$

(5) Determine PWL by entering Table 1 with $Q_L = 1.44$ and n = 4.

PWL = 98

b. PWL Determination for Air Voids

(1) Air Voids of four random samples taken from Lot A.

A-1 5.00
A-2 3.74
A-3 2.30
A-4 3.25

(2) Calculate the average air voids for the lot.

$X = (x_1 + x_2 + x_3 + . .n) / n$
$X = (5.00 + 3.74 + 2.30 + 3.25) / 4$
$X = 3.57$ percent

(3) Calculate the standard deviation S_n for the lot.

$S_n = [((3.57 – 5.00)^2 + (3.57 – 3.74)^2 + (3.57 – 2.30)^2 + (3.57 – 3.25))^2 / (4 – 1)]^{1/2}$
$S_n = [(2.04 + 0.03 + 1.62 + 0.10) / 3]^{1/2}$
$S_n = 1.12$

(4) Calculate the Lower Quality Index Q_L for the lot (L = 2.0).

$Q_L = (X – L) / S_n$
$Q_L = (3.57 – 2.00) / 1.12$
$Q_L = 1.3992$

(5) Determine P_L by entering Table 1 with $Q_L = 1.40$ and n = 4.

$P_L = 97$

(6) Calculate the Upper Quality Index Q_U for the lot (U = 5.0).

$Q_U = (U – X) / S_n$
$Q_U = (5.00 – 3.57) / 1.12$
$Q_U = 1.2702$

(7) Determine P_U by entering Table 1 with $Q_U = 1.27$ and n = 4.

$P_U = 93$

(8) Calculate Air Voids PWL.

$PWL = (P_L + P_U) - 100$
$PWL = (97 + 93) - 100 = 90$

TABLE 1. TABLE FOR ESTIMATING PERCENT OF LOT WITHIN LIMITS (PWL)						
	Positive Values of Q					
Percent Within Limits (PWL), P_L, and P_U	***n=3***	***n=4***	***n=5***	***n=6***	***n=7***	***n=8***
99	*1.1541*	*1.4700*	*1.6714*	*1.8008*	*1.8888*	*1.9520*
98	*1.1524*	*1.4400*	*1.6016*	*1.6982*	*1.7612*	*1.8053*
97	*1.1496*	*1.4100*	*1.5427*	*1.6181*	*1.6661*	*1.6993*
96	*1.1456*	*1.3800*	*1.4897*	*1.5497*	*1.5871*	*1.6127*
95	*1.1405*	*1.3500*	*1.4407*	*1.4887*	*1.5181*	*1.5381*
94	*1.1342*	*1.3200*	*1.3946*	*1.4329*	*1.4561*	*1.4716*
93	*1.1269*	*1.2900*	*1.3508*	*1.3810*	*1.3991*	*1.4112*
92	*1.1184*	*1.2600*	*1.3088*	*1.3323*	*1.3461*	*1.3554*
91	*1.1089*	*1.2300*	*1.2683*	*1.2860*	*1.2964*	*1.3032*
90	*1.0982*	*1.2000*	*1.2290*	*1.2419*	*1.2492*	*1.2541*
89	*1.0864*	*1.1700*	*1.1909*	*1.1995*	*1.2043*	*1.2075*
88	*1.0736*	*1.1400*	*1.1537*	*1.1587*	*1.1613*	*1.1630*
87	*1.0597*	*1.1100*	*1.1173*	*1.1191*	*1.1199*	*1.1204*
86	*1.0448*	*1.0800*	*1.0817*	*1.0808*	*1.0800*	*1.0794*
85	*1.0288*	*1.0500*	*1.0467*	*1.0435*	*1.0413*	*1.0399*
84	*1.0119*	*1.0200*	*1.0124*	*1.0071*	*1.0037*	*1.0015*
83	*0.9939*	*0.9900*	*0.9785*	*0.9715*	*0.9672*	*0.9643*
82	*0.9749*	*0.9600*	*0.9452*	*0.9367*	*0.9325*	*0.9281*
81	*0.9550*	*0.9300*	*0.9123*	*0.9025*	*0.8966*	*0.8928*
80	*0.9342*	*0.9000*	*0.8799*	*0.8690*	*0.8625*	*0.8583*
79	*0.9124*	*0.8700*	*0.8478*	*0.8360*	*0.8291*	*0.8245*
78	*0.8897*	*0.8400*	*0.8160*	*0.8036*	*0.7962*	*0.7915*
77	*0.8662*	*0.8100*	*0.7846*	*0.7716*	*0.7640*	*0.7590*
76	*0.8417*	*0.7800*	*0.7535*	*0.7401*	*0.7322*	*0.7271*
75	*0.8165*	*0.7500*	*0.7226*	*0.7089*	*0.7009*	*0.6958*
74	*0.7904*	*0.7200*	*0.6921*	*0.6781*	*0.6701*	*0.6649*
73	*0.7636*	*0.6900*	*0.6617*	*0.6477*	*0.6396*	*0.6344*
72	*0.7360*	*0.6600*	*0.6316*	*0.6176*	*0.6095*	*0.6044*
71	*0.7077*	*0.6300*	*0.6016*	*0.5878*	*0.5798*	*0.5747*
70	*0.6787*	*0.6000*	*0.5719*	*0.5583*	*0.5504*	*0.5454*
69	*0.6490*	*0.5700*	*0.5423*	*0.5290*	*0.5213*	*0.5164*
68	*0.6187*	*0.5400*	*0.5129*	*0.4999*	*0.4924*	*0.4877*
67	*0.5878*	*0.5100*	*0.4836*	*0.4710*	*0.4638*	*0.4592*
66	*0.5563*	*0.4800*	*0.4545*	*0.4424*	*0.4354*	*0.4310*

TABLE 1. TABLE FOR ESTIMATING PERCENT OF LOT WITHIN LIMITS (PWL)						
	Positive Values of Q					
Percent Within Limits (PWL), P_L, and P_U	n=3	n=4	n=5	n=6	n=7	n=8
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855
56	0.2164	0.1800	0.1688	0.1636	0.1613	0.1592
55	0.1806	0.1500	0.1408	0.1363	0.1338	0.1322
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264
50	0.0	0.0	0.0	0.0	0.0	0.0
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0792
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057
45	-0.1806	-0.1500	-0.1408	-0.1363	-0.1338	-0.1322
44	-0.2164	-0.1800	-0.1688	-0.1636	-0.1607	-0.1592
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4031
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4354	-0.4310
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164
30	-0.6787	-0.6000	-0.5719	-0.5583	-0.5504	-0.5454
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747

TABLE 1. TABLE FOR ESTIMATING PERCENT OF LOT WITHIN LIMITS (PWL)						
	Positive Values of Q					
Percent Within Limits (PWL), P_L, and P_U	*n=3*	*n=4*	*n=5*	*n=6*	*n=7*	*n=8*
28	*-0.7360*	*-0.6600*	*-0.6316*	*-0.6176*	*-0.6095*	*-0.6044*
27	*-0.7636*	*-0.6900*	*-0.6617*	*-0.6477*	*-0.6396*	*-0.6344*
26	*-0.7904*	*-0.7200*	*-0.6921*	*-0.6781*	*-0.6701*	*-0.6649*
25	*-0.8165*	*-0.7500*	*-0.7226*	*-0.7089*	*-0.7009*	*-0.6958*
24	*-0.8417*	*-0.7800*	*-0.7535*	*-0.7401*	*-0.7322*	*-0.7271*
23	*-0.8662*	*-0.8100*	*-0.7846*	*-0.7716*	*-0.7640*	*-0.7590*
22	*-0.8897*	*-0.8400*	*-0.8160*	*-0.8036*	*-0.7962*	*-0.7915*
21	*-0.9124*	*-0.8700*	*-0.8478*	*-0.8360*	*-0.8291*	*-0.8245*
20	*-0.9342*	*-0.9000*	*-0.8799*	*-0.8690*	*-0.8625*	*-0.8583*
19	*-0.9550*	*-0.9300*	*-0.9123*	*-0.9025*	*-0.8966*	*-0.8928*
18	*-0.9749*	*-0.9600*	*-0.9452*	*-0.9367*	*-0.9325*	*-0.9281*
17	*-0.9939*	*-0.9900*	*-0.9785*	*-0.9715*	*-0.9672*	*-0.9643*
16	*-1.0119*	*-1.0200*	*-1.0124*	*-1.0071*	*-1.0037*	*-1.0015*
15	*-1.0288*	*-1.0500*	*-1.0467*	*-1.0435*	*-1.0413*	*-1.0399*
14	*-1.0448*	*-1.0800*	*-1.0817*	*-1.0808*	*-1.0800*	*-1.0794*
13	*-1.0597*	*-1.1100*	*-1.1173*	*-1.1191*	*-1.1199*	*-1.1204*
12	*-1.0736*	*-1.1400*	*-1.1537*	*-1.1587*	*-1.1613*	*-1.1630*
11	*-1.0864*	*-1.1700*	*-1.1909*	*-1.1995*	*-1.2043*	*-1.2075*
10	*-1.0982*	*-1.2000*	*-1.2290*	*-1.2419*	*-1.2492*	*-1.2541*
9	*-1.1089*	*-1.2300*	*-1.2683*	*-1.2860*	*-1.2964*	*-1.3032*
8	*-1.1184*	*-1.2600*	*-1.3088*	*-1.3323*	*-1.3461*	*-1.3554*
7	*-1.1269*	*-1.2900*	*-1.3508*	*-1.3810*	*-1.3991*	*-1.4112*
6	*-1.1342*	*-1.3200*	*-1.3946*	*-1.4329*	*-1.4561*	*-1.4716*
5	*-1.1405*	*-1.3500*	*-1.4407*	*-1.4887*	*-1.5181*	*-1.5381*
4	*-1.1456*	*-1.3800*	*-1.4897*	*-1.5497*	*-1.5871*	*-1.6127*
3	*-1.1496*	*-1.4100*	*-1.5427*	*-1.6181*	*-1.6661*	*-1.6993*
2	*-1.1524*	*-1.4400*	*-1.6016*	*-1.6982*	*-1.7612*	*-1.8053*
1	*-1.1541*	*-1.4700*	*-1.6714*	*-1.8008*	*-1.8888*	*-1.9520*

END OF SECTION 110

13-2 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Work described in this section shall be considered incidental to other pay items and there shall be no separate payment.

END OF SECTION 13

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SECTION 14 - REMOVALS

14-1 GENERAL

This item shall consist of removing, **[salvaging], [abandoning,] [stockpiling]** and/or disposing of existing **[pavements,] [asphalt-treated bases (ATB),] [cement-treated bases (CTB),] [catch basins,] [pull boxes,] [manholes,] [light fixtures,] [ducts,] [wiring,] [concrete drainage swales,] [storm drain pipe,] [fencing,] [gates,] [posts,] [concrete slabs and footings,] [handholes,] [inlets,][other]** markings and other miscellaneous items identified from all areas within the limits designated on the plans, required by the Specifications, or as required by the Engineer.

[Removed concrete and asphalt pavement, and removed cement-treated base will be crushed for use as Processed Miscellaneous Base, [or as aggregate for Econocrete Subbase,] conforming to Sections 28 of these Specifications.]

Should a pipeline, conduit, or other utility or structure not indicated on the plans be encountered that must be removed or relocated to permit the completion of the construction work, the Contractor shall remove or relocate the interfering object as directed by the Engineer, and as required by Section 5 of the Specifications.

[Except for removed pavement and earth materials, which are to be stockpiled, crushed and/or recycled as specified in Sections 28 and 33,] Items are identified to be "salvaged" and/or "relocated", they shall be carefully removed and taken to a site as shown on the plans or as directed by the Engineer. Maximum distance for such relocation will be to the Contractors Storage Yard. All items designated "to be removed" shall be removed and legally disposed of off the airport property in conformance with Section 7-16.

14-2 CONSTRUCTION METHODS

14-2.1 General.

All items designated, or required, to be removed shall be disposed of off Airport property, unless otherwise noted, and shall be transported to a legal disposal site(s). Proof of proper disposal at a legally authorized dumping site is required.

It is the Contractor's responsibility to provide adequate and appropriate equipment to transport materials, and to maintain haul roads and stockpile sites in satisfactory condition.

[ADD / DELETE / MODIFY FOLLOWING ITEMS AS APPROPRIATE TO THE PROJECT:]

14-2.2 Removal of Pavement Materials

All **[Asphalt Concrete (AC),] [Asphalt Treated Base (ATB),] [Portland Cement Concrete (PCC)]** pavement, and **[Cement-Treated Base]** identified for removal on the plans shall be removed within the limits and to the depths shown on the Plans, unless otherwise specified. Pavement to be removed includes, but is not limited to runways, taxiways, roads, paved swales, paved infield areas, access roads and other features. Pavement shall be removed along clean straight lines by sawcutting. Existing pavement to remain in place that is damaged by the Contractor shall be repaired or replaced by the Contractor, at his expense, to the satisfaction of the Engineer. The repair or replacement method shall be approved by the Engineer prior to beginning the work. **[AC pavement,] [PCC pavement,] [ATB]** and **[CTB bases]** adjacent to like material which will remain, including any embedded metal, shall be cut with a concrete saw at all joints, phase lines, and/or match lines before removal, and as shown on the Plans. Saw-cuts shall be full depth where the existing pavement is to be removed. Where PCC pavement that is to be removed is adjacent to pavement to remain in service, the PCC shall be removed as described for full slab removal in Section 38 of these Specifications, Concrete Repair, Removal and Replacement.

[Removed PCC,] [removed AC,] [removed ATB,] [removed CTB] and all excavated earth materials which are not immediately to be incorporated into the new pavement structures, shall be transported to the **[Contractor's Staging Area and Stockpile Site where they will be crushed, blended, and stockpiled for recycling as Processed Miscellaneous Base (PMB), or as aggregate for Econocrete Base Course][a legal disposal site].** All materials unsuitable for such recycling will be removed from the airport and legally disposed of by the Contractor. PMB shall conform to Section 28 of these Specifications, and will be utilized for **[base,] [subbase]** or **[surface course materials]** in pavement shoulders, **[asphalt pavements]** and **[haul road surfacing]** as identified on the plans.

[Aggregate for Econocrete Base Course shall conform to Section 33 of these Specifications. Crushing, blending and stockpiling the materials as necessary to accomplish this goal will be considered an incidental cost of the removal of the pavement materials and no separate payment will be made. Appendix[ ] contains information on recent gradation test results from previously crushed and stockpiled materials produced from crushing operations on removed airfield pavement at the Airport. This data is from limited testing and is presented for informational purposes only. No warranty is expressed or implied that crushing from the removals under this project will duplicate these test results. The Contractor will be responsible for modifying his crushing and blending operations as necessary to produce the required result.]

Materials identified for removal and replacement with Select Fill shall be replaced with Select Fill conforming to Section 23 of these Specifications, paragraph 152-2.2.a, Select Material.

No stockpiling of any material shall be allowed anywhere on the AOA except at the designated Stockpile Site.

Cold milling of asphalt and grinding of concrete pavement to accommodate grade match or other pavement detailing is covered under Section 21 of these Specifications.

When pavement removal results in damage to adjacent pavement to remain in place, the Contractor will be required, at his expense, to repair the pavement.

For damaged asphalt concrete pavement, the damaged asphalt surface course shall be cut back at least 1 foot into sound surfacing. The removed, damaged pavement shall be replaced with asphalt concrete surfacing conforming to Section 36 of these Specifications. Contractor shall provide repair and compaction of underlaying base course if determined to be necessary by the Engineer. Application of bituminous prime coat or tack coat, as appropriate, in accordance with Sections 39 and 40 of these specifications, respectively, will be done prior to repaving. No payment will be made for this repair work.

Damaged Portland Cement Concrete pavement shall be repaired in accordance with Section 38 of these specifications. Type of repair shall depend on degree of damage, which shall be determined by the Engineer.

14-2.3 Removal of Pavement Markings.

The Contractor shall be required to obliterate, or remove, existing markings as indicated on the Plans, or directed by the Engineer, by the use of shotblasting or high pressure water to the satisfaction of the Engineer. Paint markings shall be removed from all areas to receive an asphalt overlay or other asphaltic treatment. "Paintovers" – obliteration of existing markings by covering with paint or bituminous materials will not be allowed.

Upon completion of obliteration operations, any paint, pavement, or obliteration materials left on the pavement shall be removed by means of high performance vacuum. Areas where marking obliterations have occurred shall have an emulsified asphalt fog seal placed on them bringing the pavement color back to its original color. The fog seal shall be considered incidental to the Removal of Pavement Painted Markings bid item and no separate payment will be made. Application rate shall be as approved by the Engineer.

14-2.4 Removal and/or Abandonment of Drainage System Items

All trash, debris, pipe, conduit, catch basins, pull boxes, manholes, ducts, wiring, storm drain piping, and other items being removed shall be disposed of off Airport property.

Voids resulting from abandoned or removed structures and pipes, and the volumes of underground structures and pipes identified to be abandoned in place, shall be filled with Controlled Low Strength Material (CLSM) conforming to Section 24 of these Specifications.

Whenever a pipeline, conduit, sewer, or other utility not shown on the Plans is encountered, the Contractor shall immediately inform the Engineer as required in Section 5 of the Specifications.

14-2.5 Removal of Drainage Lines

If identified on the plans, or if directed by the Engineer, all pipe, conduit, concrete encasement, drainage structures, trash, debris, and other items being removed shall be disposed of off Airport property.

Unless otherwise shown on the plans, voids resulting from abandoned or removed structures and pipes, and the volumes of underground structures and pipes identified to be abandoned in place, shall be filled with Controlled Low Strength Material (CLSM) conforming to Section 24 of these Specifications.

When drainage lines or structures are removed under existing pavement, pavement repairs shall be effected using materials conforming to the appropriate sections of these specifications. Backfill and pavement repairs or restoration will not be measured for payment.

14-2.6 Chain Link Fence Removal

Removal of Chain Link fence shall consist of the removal of chain-link fence from the locations shown on the plan, including all debris, foundations, broken concrete, and other miscellaneous items associated with the fence. Material shall be removed from the airport property and legally disposed of at the Contractor's expense.

14-2.7 Adjust Miscellaneous Structures To Grade

Manholes, inlets, handholes, and other structures and other utilities identified on the plans to be adjusted to grade shall be done in accordance with the details and standard specification references shown on the plans. Where no specific details are called out, the Contractor's method of adjusting the grade of the structure shall be submitted to, and approved by, the Engineer prior to proceeding with the work. All adjustments shall be capable of supporting the following aircraft:

(1) Dual-wheel, 48,800# per wheel gear assembly of the Boeing 727; 34 inch center-to-center wheel spacing;

(2) Dual-Tandem (four-wheel), 57,900# per wheel, gear assembly of the Boeing 747-800; 46.8 inch transverse and 56.5 inch longitudinal center-to-center wheel spacing; and

(3) Tridem (six-wheel), 58,900# per wheel, gear assembly of the Airbus A380, 53 inch transverse and 67 inch longitudinal center-to-center wheel spacing.

Contact tire pressure should be assumed to be 221 psi.

Utility systems on lines where manholes, handholes and other structures to be modified or adjusted to grade will be required to be tested after the completion of the work. No modification or adjustment will be accepted for payment until such testing is completed and approved by the Engineer.

The Contractor shall be solely responsible for all coordination with affected utility or owner agencies where adjustments to access structures are required. This shall include FAA, fuel companies, telephone and other utility companies. No modifications to the schedule will be allowed for delays due to the failure on the part

14-2.8 Fill with Select Material to Grade

Where the plans indicate removal of pavement materials and "Fill with Select Material to Grade" such material shall conform to the requirements for Select Material as discussed in Section 23 of the Specifications.

14-2.9 Dust Control

The Contractor is advised that control of dust during demolition operations is his/her sole responsibility and is of utmost importance in the safe operation of the airport. Airborne dust and debris can cause hazards to operating jet aircraft in addition to creating visibility concerns. Adequate use of water trucks or other methods of dust control shall be utilized at all times. The Engineer will retain the authority to cease all construction operations, with no modification to the allowable contract schedule, when excess dust is observed. Dust control measures will not be measured for payment, but will be considered incidental to other bid items.

14-2.10 Electrical [and NAVAIDS] Removals

Removals of electrical **[and NAVAIDS]** items are covered in Section[s]73 [and] of these Specifications**[, respectively]**.

14-2.11 [Other]

[Description of other specific removal items]

14-2.[12][ ] Miscellaneous Removals

Miscellaneous Removals shall consist of the removal of all other miscellaneous items which are necessary for the progress of the work, that are identified on the plans for removal, but which are not covered in other removals bid items. This category includes, but is not limited concrete foundations, footings and associated reinforcement; junction cans and boxes, electrical fixtures, duct, conduit, cable and appurtenances not paid under Section 73, and all other items identified on the plans for removals which are not expressly covered under other removals pay items.

14-3 MEASUREMENT.

14-3.1 The quantity of Remove **[Asphalt Concrete (AC),] [Asphalt Treated Base (ATB),] [Portland Cement Concrete (PCC)]** pavement, and **[Cement-Treated Base]** to be paid for shall be the number of square yards of pavement removed, regardless of thickness, which is

removed from the airport and legally disposed of. No guarantee of the thicknesses shown is expressed or implied, and variations from the thickness shall not be construed to change the amount to be paid for pavement removal. Underlying aggregate base, subbase and soil strata shall be removed, measured and paid under Unclassified Excavation, Section 23 of these Specifications, Earthwork. The Contractor shall provide documentation of legal disposal.

14-3.2 Remove and Crush [Asphalt Pavement]|[Portland Cement Concrete]|[CTB] shall be made at the contract unit price per square yard, for removing and crushing pavement of the type specified, regardless of thickness

14-3.3 Remove Painted Pavement Markings. Pavement marking removal shall be measured by the square foot of removed marking. No measurement of fog seal will be made but is shall be considered incidental to the pavement marking removal.

14-3.4 Remove and/or Abandon Drainage System Items

Removal and/or abandonment of drainage system items will be measured by each item removed and/or abandoned in accordance with the plans or as directed by the Engineer.

14-3.5 Remove Drainage Lines

Drainage lines removed shall be measured for payment by the linear foot of lines removed. No separate measurement for excavation or backfill will be made which will be considered incidental to the removal.

14-3.6 Remove Chain-link Fence

Chain-link fence removed shall be measured for payment by the linear foot of fence removed and disposed of. Gates will be measured as fence.

14-3.7 Adjust Miscellaneous Structures to Grade

Adjustment of miscellaneous structures to grade shall be measured for payment by the number of items adjusted in accordance with the plans and specs or as directed by the Engineer.

14-3.8 Fill with Select Material

No measurement will be made for items requiring Select Fill. Fill will be considered incidental to other bid items and no separate payment will be made.

14-3.9 Dust Control

No measurement will be made for Dust Control, which will be considered incidental to other bid items and no separate payment will be made.

14-3.10 Electrical [and NAVAIDS] Removals

Measurement of removal of electrical **[and NAVAIDS]** items will be made as described in Section[s]73 [and] of these Specifications**[, respectively]**.

14-3.11 [Other]

[Describe measurement]

14-3.[ ] Miscellaneous Removals.

Removal and disposal of all other items not addressed herein but identified on the plans shall be measured for payment as one lump sum item of work.

14-4 BASIS OF PAYMENT

14-4.1 Payment for Remove **[Asphalt Concrete (AC),] [Asphalt Treated Base (ATB),] [Portland Cement Concrete (PCC)]** pavement, and **[Cement-Treated Base]** shall be made at the contract unit price per square yard of the type of pavement removed, which price and payment shall constitute full compensation for all equipment, material, labor and supervision to saw-cut, load, remove and dispose off the airport, regardless of thickness. No separate payment shall be made for saw-cuts or for cold-milling or grinding, if required.

14-4.2 Payment for Remove and Crush **[Asphalt Pavement][Portland Cement Concrete][CTB]** shall be made at the contract unit price per square yard, which price and payment shall constitute full compensation for all equipment, material, labor and supervision to cut, load, remove to the stockpile area, crush, blend and stockpile existing pavement of the type specified, in conformance with the specifications, regardless of thickness. This item includes the removal of all metal or miscellaneous embedments in the existing pavement. No separate payment shall be made for saw-cuts, crushing, blending or stockpiling.

14-4.3 Payment for Remove Pavement Painted Markings shall be made at the contract unit price per square foot, which price shall constitute full compensation for all equipment, materials, labor, and supervision for complete removal. No separate payment will be made for fog seal.

14-4.4 Payment for Remove and/or Abandon Drainage System Items shall be at the contract price for each structure removed and/or abandoned, regardless of size, and shall constitute full compensation for all equipment, materials, labor and supervision required for performing all work involved in backfilling with CLSM, and abandonment of the drainage system items as shown on the plans or as directed by the Engineer.

14-4.4 Payment for Remove Storm Drain Lines shall be at the contract price per lineal foot of removed pipe, regardless of size, and shall constitute full compensation for all equipment,

materials, labor and supervision required for performing all work involved in demolition, removals, backfilling, and disposal of the existing storm drain lines as shown on the plans or as directed by the Engineer.

14-4.5 Payment for Remove Chain Link Fence shall be made at the contract unit price per lineal foot, which price shall constitute full compensation for all equipment, materials, labor, and supervision for complete removal and disposal.

14-4.6 Payment for Adjustment of Miscellaneous Structures to Grade shall be at the contract price for each structure adjusted to grade, regardless of size, and shall constitute full compensation for all equipment, materials, labor and supervision required for performing all work involved in adjust structures as shown on the plans or as directed by the Engineer.

14-4.7 No payment will be made for Select Fill, or for Dust Control, which shall be considered incidental to other bid items.

14-4.8 Payment for removal of electrical **[and NAVAIDS]** items will be made as described in Section[s]73 [and] of these Specifications**[, respectively]**.

14-4.9 [Other]

[Describe payment]

14-4.[ ] Payment for Remove Miscellaneous Items shall be made at the contract lump sum price, which price shall constitute full compensation for all equipment, materials, labor, and supervision for complete removal and disposal of all miscellaneous removals items shown on the plans, including miscellaneous electrical and storm drain items, which are not paid under other bid items.

Testing and disposal of contaminated soils, as described in Section 23 of these specifications, shall be undertaken as required.

Soil sampling, in conformance with Section 23-3, shall be conducted at the site of suspected contaminated soils for all removals operations.

No additional payment shall be made for difficulties encountered when making removals in areas of night, weekend or other limited-time construction, or in other areas subject to construction phasing restrictions.

Payment shall be made under:

Item 14.1 Remove **[Asphalt Concrete (AC),] [Asphalt Treated Base (ATB),] [Portland Cement Concrete (PCC)] [Cement-Treated Base]** Pavement .....per square yard

Item 14.2 Remove and Crush**[Asphalt Pavement]|[Portland Cement Concrete]|[CTB]** Pavement .....per square yard

Item 14.3 Remove Painted Pavement Markings.....per square foot

Item 14.4 Remove and/or Abandon Drainage Structures ..... per each

Item 14.5 Remove Storm Drain Lines .....per linear foot

Item 14.6 Remove Chain Link Fence .....per linear foot

Item 14.7 Adjust **[ ]** to Grade ..... per each

Item 14.8 [Other] ..... per **[each]|[linear feet]|[lump sum]**

Item 14.**[ ]** Miscellaneous Removals .....per lump sum

END OF SECTION 14

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SECTION 15 - WATERING

15-1 GENERAL

Watering shall consist of furnishing and applying water as required for compaction of embankments, subgrades, subbase and/or base courses, dust control and miscellaneous other construction needs.

15-2 FURNISHING WATER

The Contractor shall provide and maintain, at the Contractor's own expense, an adequate supply of water of a quality suitable for the required construction and for domestic use. The Contractor shall investigate the availability of suitable water, make all arrangements for the purchase of the water, and provide all facilities necessary to furnish water for his use during construction. The Contractor shall not draw any water from a fire hydrant for use on the work without first obtaining a written permit and meter from the **[City of Los Angeles][ ]**Water Department.

[In case water is to be furnished from mains owned and controlled by Los Angeles World Airports, this permission must be obtained from the Airports Engineer. An Eddy Valve approved by the Engineer shall be supplied by the Contractor, at Contractor's own expense, for any connection to Los Angeles World Airports water mains. Recycled water for dust control will be available to the Contractor at no charge.]

The Contractor shall keep available at the job site, at all times, a minimum of **[two (2)][four (4)]** self-loading operational vacuum motor sweepers, TYMCO, Model 300 or Engineer-approved equivalent, and **[one (1)][two (2)]** water trucks to maintain dust control and cleaning of pavements affected by Contractor operations, and shall use this equipment as needed to keep pavement areas swept clean of debris, to the satisfaction of the Engineer.

Sweepers shall be stationed within work areas to provide swift response as needed, i.e., active taxiway crossings, etc.

15-3 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment for furnishing and applying water shall be deemed to be included in the prices paid for various items of work involved. No separate payment will be made for furnishing and applying water. Self-loading vacuum motor sweepers and water trucks will be considered incidental to the construction and no separate payment will be made.

END OF SECTION 15

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SECTION 16 – MOBILIZATION - DEMOBILIZATION

16-1 GENERAL

Mobilization shall consist of obtaining all required insurance, bonds and permits; preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; preparation of a construction schedule; furnishing and erecting field offices, laboratory, batch plants, and other facilities necessary for work on the project; badging and training of flaggers, escorts, gate guards and other employees as specified herein; and all other work which must be performed or cost incurred prior to beginning work on the various contract items at the project site.

A. Principal Items of Mobilization

Mobilization shall include the following principal items:

(1) Insurance as required by Subsections 7-3 and 7-4 of these specifications.

(2) Bonds as required by Subsection 2-4 of these specifications.

(3) Permits for this project, including **[Building Permits,] [Electrical Permits,] [CalTrans permits,] [water use permits,] [FAA 7460-1 permit,]** and as otherswise required by Subsection 7-5 of these specifications.

(4) The schedule of costs breakdown of the Bid as required in Subsections 9-2 and 19 of these Specifications.

(5) The Contractor's approved Baseline Construction Schedule as required by Section 19.

(6) Contractor’s Operation and Storage Yard (Staging Area), including the complete installation of all field offices and laboratories**[, with utilities], [fencing and gates], [anti-tracking plates,]**and supplies as required by Subsections 8-2 and 8-3 of these specifications.

[(7) Installation of **[multiple] [concrete batch] [asphalt batch**] **[crusher]** plants and all appurtenances necessary for fully functional facilities of adequate combined capacity to meet project production needs.]

(8) Moving onto the Site all equipment required for the first thirty (30) days of construction.

(9) Posting all required OSHA notices and establishing on-site safety programs.

(10) Submittals of Shop and Coordination Drawings and Job Mixes for the first thirty (30) days of construction.

(11) Security badging and training of all **[flaggers,] [gate guards,] [escorts] [and other]** employees **[and subconsultants][, including any escort training,] [driver's training] [and insurance for vehicles]** as required for the first thirty (30) days of construction.

[(12) Procurement and transport of long lead construction materials to the job site.]

[(13) Procurement of barricades, flag lines and fences as depicted in the construction drawings.]

[(14) Pre-demolition work.]

[(15) Pre-construction work.]

B. Demobilization

Demobilization shall include removal of construction facilities, including all utilities, and equipment off the Site and final cleanup of the Site after completion of the Project.

16-2 METHOD OF MEASUREMENT

["Mobilization – Demobilization" will be measured as a complete item for payment when requirements of Section 16-1A and 1.1B are completed. Ninety percent (90%) of the unit price will be paid when the principal items described in Items 16-1.1A above have been completed so that work can commence on other pay items. The balance will be paid when the items listed in paragraph 16-1.2 are complete.]

["Mobilization - Insurance, Bonds, Permits" will be measured as a complete item for payment when Items 1, 2, and 3 of Section 16-1.1.A are completed.]

["Mobilization - Plants, Batch and Crushing" will be measured as a complete item for payment when Item 7 of Section 16-1.1A is completed.]

["Mobilization - Field Offices and Contractor Site Improvements" will be measured as a complete item for payment when Items 6, 8, 9 and 11 of Section 16-1.1A are completed. 25% of the contract lump sum bid amount will be paid when the office and site improvements are in place and accepted. The remaining 75% will be prorated and paid over the course of the project schedule.]

["Mobilization - Scheduling and Cost Breakdown Submittals" will be measured as a complete item for payment when Items 4 and 5 of Section 16-1.1A are completed.]

["Mobilization - Job Mix and Shop Drawing Submittals" will be measured as a complete item for payment when Item 10 of Section 16-1.1A is completed.]

16-3 BASIS OF PAYMENT

Payment for mobilization will be made when the items described above, have been completed.

The right is reserved to require submittal of invoices, receipted bills, payrolls, and other appropriate documents to justify any or all payment under this item. When contract items are altered as provided in the Standard Specifications, no additional mobilization costs will be allowed.

Payment will be made under:

[Bid Item 16.1 Mobilization – Demobilization ..... per lump sum]

[Bid Item 16.1 Mobilization - Insurance, Bonds, Permits..... per lump sum]

[Bid Item 16.2 Mobilization - Plants, Batch and Crushing ..... per lump sum]

[Bid Item 16.3 Mobilization - Field Offices and Contractor Site Improvements ..... per lump sum]

[Bid Item 16.4 Mobilization - Scheduling and Cost Breakdown Submittals ..... per lump sum]

[Bid Item 16.5 Mobilization - Job Mix Formulae Laboratory Work and Submittals..... per lump sum]

END OF SECTION 16

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SECTION 17 - TRAFFIC CONTROL, FLAGGERS, AND GATE GUARDS

17-1 GENERAL

Under this section, the Contractor will provide traffic control, flaggers, escorts and gate guards for construction traffic control for the project. This item will not be measured for payment but will be considered incidental to other bid items. **[The Contractor shall also provide escorts for his crews, subcontractors and all third parties that do not have the AOA driving privileges.]** It is the Contractor's responsibility to estimate the manpower needed to provide these services in conformance with LAWA and FAA regulations as discussed in various sections of these Specifications and Contract Documents, and as required for the Contractor's proposed methods of operation.

< Add Description of Special Requirements, Conditions>

Additional requirements relative to the badging, training and operational requirements of traffic control, flaggers, escorts and guard guards are discussed in Sections 7 and 10, and in Appendices B and C, of these Specifications.

17-2 METHODS

17-2.1 Training and Security Badging of Employees. See Appendices **[ ] [and]** of these Specifications relative to requirements for training and security badging of employees.

17.2.2 [Escorts and] Flaggers. The Contractor shall conduct all operations in a manner that will cause no interference with aircraft traffic or normal operation of the airport. The Contractor shall furnish flaggers to regulate the movements of his vehicles and equipment when it is necessary for a vehicle or piece of equipment to cross an active taxiway, or when working within **[125]** feet of an active taxiway. No crossings of active runways will be allowed. When an aircraft approaches work in progress adjacent to an active taxiway, the workers and equipment shall be withdrawn to a safe distance until the aircraft has passed. Aircraft shall always have the right-of-way. **[Operational light plants shall be required for each flagger during non daylight hours.]**

a. **Flaggers**: When an aircraft approaches work in progress adjacent to an active taxiway, the workers and equipment shall be withdrawn to a safe distance until the aircraft has passed. Aircraft shall always have the right-of-way.

b. **Escorts:**

At all times during work within **[250]** feet of the centerline of an operating runway or **[125]** feet of the centerline of an operating taxiway, or when entering or crossing an active movement area, vehicles shall be accompanied by an approved radio equipped escort car.

Escorting shall be conducted on a one-to-one ratio (one escort vehicle for every vehicle to be escorted), unless approved by the Engineer, in advance, in writing.

17-2.3 Gate Guards.

The Contractor shall provide security guards at laydown area entrance and gates which he uses for ingress and egress through the Airport perimeter security fences when these gates are required to be open for the Contractor's vehicles. The Contractor shall stop any unauthorized person entering or exiting the Airport through these gates. Otherwise the gates shall be closed and locked. Airfield security shall be maintained at all times.

The Contractor shall provide **[two (2)] [three (3)]** security guards at the AOA access point and **[two (2)][three (3)]** security guards at the entrance to the staging area used by the Contractor. The Contractor shall train personnel to maintain security at point of entry and the Contractor shall instruct the guard as follows:

a. The gate shall be opened to allow vehicular passage, and closed at all other times.

b. All vehicles must have an approved logo or company name displayed on both sides of the vehicle.

c. Except for escorted vehicles, all persons entering the AOA must display either a current LAX picture I.D. badge issued by Airfield Clearance or a yellow temporary badge issued by the Contractor.

d. An LAX I.D. badge/driver's license is required for all drivers. (See "Authorized Vehicles on the AOA," and "Escort Vehicles", Appendix **[ ]**).

e. All Contractors, equipment and vehicles entering the AOA must display a checkered flag mounted firmly on the highest part of the vehicle. Flags shall be replaced when they become worn and tattered as directed by the engineer.

f. Unless a gate guard is performing guard duty, the gate must be secured and locked.

g. Perform vehicle inspections for all project vehicles entering the AOA.

h. No one is allowed to enter the AOA unless the preceding conditions are met.

i. All escort vehicles must be in radio/telephone contact with a base that is occupied full-time and has contact with LAWA Ops/Inspection at all times. No separate payment will be made for maintaining the base.

j. See other requirements as described in Appendices [ ] [and] and in Sections 2, 7 and 10 of these Specifications.

17-2.4 Requirements and Regulations Relating to the Operation of Motor Vehicles. See Sections 7 and 10, and in Appendix [ ], of these Specifications for requirements relating to the operation of motor vehicles on the airport.

17-2.5 Safety and Security Plan Submittal. Relative to the individuals providing traffic control, flagging, escorting and gate guarding duties, the Contractor's safety control plan shall include the following information:

a. Identification and 24-hour phone/pager contact for the Safety Officer.

b. List of individuals who will be authorized escort drivers.

c. List of access gates, gate hours and names of gate guards.

d. [Identification of individual(s) to be responsible for communication base for escort vehicles. This base radio will be the only one authorized to transmit to LAWA Ops or Inspection. All escort vehicles must have receiving radios to monitor transmissions from LAWA Ops or Inspection.]

17-2.6 Traffic Control. In addition to the requirements specified in other sections, the following Safety Requirements shall also apply to the Contractor's activities:

a. **Traffic Control.** The Contractor shall furnish all required traffic control to protect the public outside the AOA. The actions, equipment and position of flaggers, when required, shall be the sole responsibility of the Contractor. The Contractor shall provide flaggers and construction traffic control on public facilities in accordance local jurisdiction requirements and the current edition of the Manual of Uniform Traffic Control Devices (MUTCD) and as required by other sections of these specifications.

b. **Violations.** In the event an employee of the Contractor violates a safety provision, they shall be prohibited from returning to work on the AOA without first attending another Airport Safety Orientation class and approval of the Engineer. Violations will be deemed as just and sufficient cause to demand the employee be permanently removed from the job site. The Contractor shall be responsible for all costs and delays caused by safety violation.

c. **Contractor's Designated Representative**. The Contractor shall inform its supervisors and workmen of the airport activity and operations that are inherent to this airport, as well as the safety requirements and security regulations of the airport. The Contractor shall conduct its construction activities to conform to both routine and emergency requirements. During the course of construction, the Contractor shall designate a responsible representative who will be personally available on a 24 hour basis. The Contractor shall advise the Engineer of the representative's name and telephone number (the telephone shall not be connected

to an answering machine). The Contractor shall comply with all current safety laws, ordinances and regulations as they may apply to this contract.

17-3 METHOD OF MEASUREMENT

[Airfield traffic control, flaggers**[, escorts]** and gate guards, as required by the plans and specifications for the duration of the project shall not be measured for payment but will be considered incidental to other bid items.]

[Work under this Section will be measured for payment as a single lump sum item for supplying airfield traffic control, flaggers**[, escorts]** and gate guards, as required by the plans and specifications for the duration of the project.]

17-4 BASIS OF PAYMENT

[No separate payment will be made for providing airfield traffic control**[, escorts],** and flaggers,. All labor, supervision, material, equipment, training, badging or other costs necessary to provide these services to satisfy the requirements as specified in various sections of these Specifications shall be considered incidental to other bid items.]

[Airfield traffic control, flaggers**[, escorts]** and gate guards will be paid at the contract lump sum price, which price shall constitute full compensation for all equipment, materials, labor, and supervision for providing and maintaining complete temporary erosion control services as described herein for the duration of the project.

Payment will be made under:

Item 17.1 Airfield Traffic Control, Flaggers**[, Escorts]** and Gate Guards ..... per lump sum]

END OF SECTION 17

SECTION 18 – LOCATION OF UNDERGROUND UTILITIES

18-1 GENERAL

Under this section, the Contractor will provide potholing for establishing and confirming utility location and depth of utilities that are not shown on the plans, or for potholing requested by the Engineer.

Potholing of utilities that are shown on the plans shall be considered incidental to the associated work items and no separate payment will be made. Potholing of utilities not shown on the plans, and approved by the Engineer prior to proceeding with the work, will be paid under this section.

[Potholing in areas identified on the plans as Oil or Fuel Company rights-of-way will be subject to the additional requirements outlined in Section 50, Oil Company Right-of-Way Requirements.]

Potholing for utilities will be of two types, hand dug and machine dug.

18-2 METHODS

Prior to the beginning of earthwork operations, or any work which may impact nearby underground utilities, the Contractor shall provide 12-inch diameter potholes for locating fuel lines, storm drains, electrical conduit and other utility lines crossing the construction areas. Prior to digging potholes, the Contractor shall indicate to the Engineer the specific potholes he plans to excavate. The method of potholing, whether by hand or by machine, will be as directed by the Engineer. Equipment and tools shall be approved by the Engineer.

Prior to beginning the work for any pothole, the prior approval of the Engineer for the number, location and method of digging potholes shall be obtained. All necessary permits from Underground Services Alert ("USA") and FAA shall also be in effect. Permits are the responsibility of the Contractor. From the elevation information obtained from these potholes, the Contractor shall provide survey to establish the elevations of the top of the exposed utility lines for the Engineer, and for the purpose of establishing methods of protecting the structures during construction activities.

The Contractor shall expose and verify, by survey, the depth and alignment of all underground utilities in the construction site for each phase. The Contractor shall pothole and survey all utilities where they enter the horizontal limits of any new pavement construction, and anywhere they cross a new storm drain or electrical duct installation. The Contractor shall notify the Engineer immediately, in writing, of any conflicts between the project work and any existing utility. Pothole elevations shall be included in the "as-built" construction plans. The Engineer may request additional potholes at anytime.

See Section 5 of these Specifications for additional requirements relative to locating underground utilities.

18-3 METHOD OF MEASUREMENT

Measurement for payment will be the number of potholes of the types indicated, as directed and/or approved by the Engineer in the field, completed to the satisfaction of the Engineer.

18-4 BASIS OF PAYMENT

Payment for exploratory potholes for utilities not shown on the plans, and made with the Engineer's prior approval, will be made at the contract unit price per pothole of each type indicated, which price shall include all necessary labor, supervision, tools, equipment, permits and incidentals to excavate, identify and survey the utility. Potholes for utilities that are shown on the plans are considered incidental to associated bid items and no separate payment will be made.

No additional payment will be made for difficulties encountered when accomplishing the work under night construction conditions.

Payment will be made under:

[Item 18.1 Potholes - Hand.....per each]

[Item 18.2 Potholes - Machine .....per each]

END OF SECTION 18

SECTION 19 – CONTRACTOR'S CONSTRUCTION SCHEDULE AND REPORTS

19-1 PROGRESS OF THE WORK

It is expressly understood and agreed that the time of beginning, the rate of progress, and the time of completion of the Work are of the essence in this Contract. The Work shall be executed with such progress as required to prevent any delay to other contractors working on other contracts at the Site, the Contract milestones, the Contract Completion Date and approved Construction Schedule.

19-2 CONTRACTOR'S CONSTRUCTION SCHEDULER.

The Contractor is required to employ or retain the services of a Construction Scheduler, an individual other than the Contractor's Project Engineer. The Construction Scheduler shall have at least five (5) years of verifiable experience as the person primarily responsible for preparing and maintaining detailed Project schedules on projects of the same or similar size and nature as this Project. The Contractor shall submit the Construction Scheduler's background data to the Engineer at the Pre-Construction Scheduling Conference. The Construction Scheduler is required to attend all meetings pertaining to scheduling and progress of the Work, including weekly job meetings. If the Construction Scheduler leaves the employ of the Contractor, the Contractor will be required to fulfill the requirements of Subsection19-2 within thirty (30) Days.

Within five (5) Days after the Notice of Award date, the Contractor shall provide a statement to the Engineer with the following:

1) Identification, qualifications, and experience of the Contractor's Construction Scheduler and all other members of the Contractor's scheduling staff.
2) References of not less than two (2) previous projects on which the Contractor's Construction Scheduler has utilized CPM scheduling.
3) A description of the Scheduling System to be utilized.

The Engineer reserves the right to disapprove any candidate or Scheduling System proposed for the Project. The Engineer reserves the right to remove, without rights to Work on the Project, any member of the Contractor's scheduling staff that is, in the Engineer's or Inspector's opinion, not performing scheduling work in accordance with the scheduling requirements.

19-3 GENERAL.

The scheduling method to be used shall be a Critical Path Method schedule in the form of an activity on node Precedence Diagram Network (PDN) with capabilities of identifying the critical path. The principles and definitions of the terms used herein shall be as set forth in the Associated General Contractors of America's publication "The Use of CPM in Construction,"

latest edition. To the extent there are any conflicts between the Associated General Contractors of America's publication and the Contract Documents, the Contract Documents shall govern.

The Contractor shall submit to the Engineer for approval, at the Pre-Construction Scheduling Conference, all of the following:

1) A Work Breakdown Structure.
2) The associated alphanumeric coding structure to implement the Work breakdown structure.
3) The activity identification system for labeling all Work activities.

The first code field shall designate the bid item. The second code field shall identify the type of activity. (Types of activities shall be defined as "submittal," "review/approval," "procurement/fabrication," "delivery," "construction/installation" or "Change Order.") The third code field shall identify which Specification Section the activity shall be paid under. The fourth code field shall identify who is responsible to perform the activity (e.g., Contractor, Subcontractor(s) by trade, Supplier, etc.). The fifth code field shall identify the area being worked in or the facility, if appropriate. The sixth code field shall identify the construction phase or Project element (if phasing of Work or Project elements are identified in the Contract.) All Change Orders and Notices of Non-Compliance shall be included as separate code fields.

The Contractor shall use the latest version of Primavera Project Planner (P3) for Windows, latest edition, and a hardware system commensurate with the size of the Project. This shall be referred to as the Scheduling System. The system shall be capable of handling, processing, printing, and plotting data to satisfy all requirements of these Contract Documents. The Contractor shall maintain the Scheduling System, the schedule, and the scheduling staff on Site or at a location approved by the Engineer.

Within fifteen (15) Days after the Notice to Proceed, the Contractor shall submit a separate submittal schedule listing all submittals required under the Contract. This schedule shall show when each submittal will be submitted.

[PE: The paragraph below is optional. Use to provide incentive for the Contractor to submit schedule. If used, delete "liquidated damages" paragraph in 19-9.]

[The Contractor will receive an additional incentive payment of $_____ for the Baseline Construction Schedule and $_____ amount per month for submitting monthly schedules that meet specified requirements. Schedules must be submitted in the time specified and must include the items listed in Section 19 each month or that month's incentive payment will be forfeited.]

19-4 PRE-CONSTRUCTION SCHEDULING CONFERENCE.

The Engineer will schedule and conduct a Pre-Construction Scheduling Conference with the Contractor's Project Manager, General Superintendent, and Construction Scheduler within seven (7) Days after the Notice of Award date, to commence development of the required Preliminary Construction Schedule. At this meeting, the requirements of this Section will be reviewed. The Contractor shall be prepared to review and discuss methodology for the schedule and sequence of operations plus cost, labor, and equipment-loading methodology.

19-5 CONTRACTOR'S PRELIMINARY CONSTRUCTION SCHEDULE.

Within seven (7) Days after the Pre-Construction Scheduling Conference, the Contractor shall submit to the Engineer the Preliminary Construction Schedule for the first ninety (90) Days of Work after the Notice to Proceed date, as well as a general approach for the remainder of the Work.

The Engineer, Inspector, Contractor and its Construction Scheduler shall meet within seven (7) Days after submittal of the Preliminary Construction Schedule to review and make any necessary adjustments or revisions. The Contractor shall submit the revised Preliminary Construction Schedule within five (5) Days after receiving comments. The Preliminary Construction Schedule, when revised, will represent the Contractor's planned means, methods, and sequences for performance of the Work during the first ninety (90) Days after the Notice to Proceed date and is to be incorporated as the first ninety (90) Days of the Contractor's Baseline Construction Schedule.

The Preliminary Construction Schedule shall include all resources assigned to each activity. Costs assigned will generally conform to the Contractor's bid item unit prices and/or such lump sum bid item breakdowns as the Inspector shall approve. The schedule of labor and costs shall be realistic and level, avoiding any unusual labor requirements.

The resultant Preliminary Construction Schedule, when approved by the Engineer, shall be the sole basis of partial or progress payments made for Work performed during the first ninety (90) Days after the Notice to Proceed.

Submittal and approval of the Preliminary Construction Schedule is a condition precedent to the issuance and payment of progress payments. Therefore, no construction Work will be permitted and no progress payments will be made until the Engineer has approved the Preliminary Construction Schedule.

The Preliminary Construction Schedule shall be updated monthly during the first ninety (90) Days after the Notice to Proceed date, as a part of the payment application process.

19-6 CONTRACTOR'S BASELINE CONSTRUCTION SCHEDULE.

Seven (7) Days after approval of the Preliminary Construction Schedule, the Engineer shall meet with the Contractor and its Construction Scheduler to receive an update on the progress in the

development of the Baseline Construction Schedule. The Contractor shall prepare and submit to the Engineer the Baseline Construction Schedule within fifteen (15) Days after approval of the Preliminary Construction Schedule.

The Baseline Construction Schedule shall show the sequence and interdependence of activities required for complete performance of the Work, beginning with the date of the Notice to Proceed and concluding with the Contract Completion Date shown in the Contract Documents.

Pursuant to the float sharing requirements of the Contract, use of float suppression techniques such as preferential sequencing, special lead/lag logic restraints, extended activity times or imposed dates shall be cause for rejection of the Baseline Construction Schedule and any revisions or updates. The use of float time disclosed or implied by the use of alternative float suppression techniques shall be shared as directed by the Engineer.

If the Contractor submits a Baseline Construction Schedule showing completion of the Work more than thirty (30) Days in advance of the Contract Completion Date, the Contractor agrees that the Agency may, at no cost to the Agency, decrease the Contract duration by issuance of a Change Order which will change the appropriate Milestone Date(s) and the Contract Completion Date to the completion date reflected on the Monthly Updated Project Schedule. Any approved schedule, revision, or update having an early completion date shall show the time between the early completion date and the current Contract Completion Date as "project float." Unless the Contractor can demonstrate that he/she bid the Project based upon the early completion schedule, the Agency will also deduct the home office and field overhead costs associated with the amount of time the Contract duration is decreased.

The Engineer will review and make comments on the Baseline Construction Schedule. Meetings will be held between the Engineer, the Contractor, Construction Scheduler and all major Subcontractors and Suppliers to resolve any conflicts between the Baseline Construction Schedule and the intent of the Contract. (The term "major Subcontractors and Suppliers" as used in this Section, shall include any Subcontractor or Supplier with five percent (5%) or more of the value of the Contract.) Other Subcontractor or Supplier representatives whom the Contractor may desire to invite or whom the Engineer may request, shall attend.

Comments made by the Engineer on the Baseline Construction Schedule, during review, will not relieve the Contractor from compliance with requirements of the Contract Documents. To the extent that there are any conflicts between the approved schedule and the requirements of the Contract Documents, the Contract Documents shall govern.

19-7 NETWORK DETAILS.

The Baseline Construction Schedule shall include time-scaled network diagrams, as well as computer tabulations. It shall be constructed to show the order in which the Contractor proposes to carry out the Work, to indicate restrictions of access and to show availability of Work areas, and availability and use of labor, materials and equipment. The Contractor shall utilize the

Baseline Construction Schedule in planning, scheduling, coordinating, and performing the Work under the Contract (including all activities of Subcontractors, equipment vendors, and Suppliers). The Contractor will provide the Engineer with written confirmation of the concurrence of all major Subcontractors and Suppliers with the Baseline Construction Schedule and all revisions and updates.

The following criteria shall form the basis for assembly of the schedule logic:

1) Which activity must be completed before a subsequent activity can be started?
2) Which activities can be done concurrently?
3) Which activity must be started immediately following a completed activity?
4) What major economic facility or labor restrictions are required for sequencing these activities?

The Baseline Construction Schedule shall provide the Engineer with a tool to monitor and follow the progress of all phases of the Work. The Baseline Construction Schedule submitted to the Engineer shall comply with all limits imposed by the scope of Work, with all contractually specified intermediate milestone and completion dates, and with all constraints, restraints or sequences included in the Contract. The degree of detail shall include factors to the satisfaction of the Engineer, including, but not limited to each of the following:

1) Physical and structural breakdown of the Project.
2) Contract milestones and completion dates, Substantial Completion dates, constraints, restraints, sequences of Work shown in the Contract, the planned Substantial Completion date, and the Contract Completion Date.
3) Type of Work to be performed, the sequences, and the labor trades involved.
4) All purchase, submittal, submittal review, manufacturing, test, delivery, and installation activities for all major materials and equipment, and a separate list of all major material items or items of equipment for which the Contractor intends to seek payment prior to installation.
5) Deliveries of Agency-furnished equipment and/or materials in accordance with the dates or schedule windows of such items set forth in the Contract or furnished by the Engineer.
6) Preparation, submittal, and approval of shop and/or working drawings, and material samples showing a thirty (30) Day minimum time specified for the Engineer's review of all submittals, or longer as identified in the Contract. The same time frame shall be allowed for at least one (1) resubmittal on all major submittals so identified in the Contract Documents.
7) Approvals required by regulatory agencies or other third parties.
8) Plans for all subcontract Work.
9) Assignment of responsibility for performing specific activities.
10) Access to and availability of work areas including all anticipated shutdowns.
11) Identification of interfaces and dependencies with preceding, concurrent and follow-on Contractors and utilities.
12) Resource loading for cost, labor, material, and equipment.

13) Actual tests, submission of test reports, and approval of test results.
14) All start up, testing, training, and assistance required under the Contract.
15) Planning for phased or total takeover by the Agency.
16) Punchlist and final cleanup.
17) Identification of any labor, material, or equipment restrictions, as well as any activity requiring unusual shift Work, such as two shifts, six (6) day weeks, specified overtime, or Work at times other than regular days or hours, shall be clearly identified in the Baseline Construction Schedule.

The activities included in the Baseline Construction Schedule shall be analyzed in detail to determine activity time durations in units of days. Durations shall be based on the labor (crafts), equipment, and materials required to perform each activity on a normal workday basis. No activity shall have a duration over fifteen (15) Days except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment, and concrete curing. All construction activities shall be shown in their resource-loaded state to reflect cost, labor, materials and equipment except for those activities under Subsection 19-7. All durations shall be the result of definitive labor and resource planning by the Contractor to perform the Work according to the Contract Documents. The labor to be assigned by craft, definition, equipment, and bid item designation, shall be shown for each construction activity for the network on a tabular listing, and in information furnished in accordance with Subsections 19-16 and 19-17. All crafts necessary to execute an activity must be shown. No more than five (5) crafts may be assigned to a specific activity. If more crafts are required, then the activity in question must be broken down into additional activities.

The Contractor is required to use labor or equipment restraints, separately noted, to optimize and level labor and equipment requirements. Such resource leveling shall reflect a reasonable plan for accomplishing the Work. The individual activities involved may be sequenced within the limits of the available total float. However, when this leveling technique is used in establishing the initial schedule, it shall be reflected in the logic with restraints identified as "restraint for labor or equipment leveling purposes only." Critical or near critical paths resulting from the use of labor restraints shall be kept to a minimum. Near critical paths shall be defined as those paths having fifteen (15) Days or less of total float at the time of initial submission.

The estimated cost to perform each Work activity shall be noted for each activity in the network on a tabular listing. The sum of the costs assigned to all activities shall equal the Contract value. No activity costs shall be assigned to submittals or submittal reviews. The accepted cost-loaded Baseline Construction Schedule shall constitute the Schedule of Values from which monthly progress payments will be made in accordance with the provisions of Subsection 9-3.

The network diagram shall be prepared on (E) size sheets (twenty-eight [28] inches by forty [40] inches), shall have a title block in the lower right-hand corner, and a timeline on each page. Exceptions to the size of the network sheets and the use of computer graphics to generate the networks shall be subject to the approval of the Engineer.

All networks shall be drafted time scaled to show a continuous flow of information from left to right. The primary path(s) of criticality shall be clearly and graphically identified on the network(s).

As part of each update submission, the status of Work in progress shall also be similarly identified and the reported percent complete graphically indicated for each activity remaining in progress as of the last report period.

19-8 BASELINE CONSTRUCTION SCHEDULE.

The Baseline Construction Schedule submitted to the Engineer shall include the time scaled network diagram (for the full network of activities as well as the Master Summary Schedule described below). Network diagrams shall be based on early start and early finish dates of activities shown. The network diagrams submitted to the Engineer shall also be accompanied by a computer-generated mathematical analysis for each activity included in the Baseline Construction Schedule. Such mathematical analysis shall be submitted to the Engineer and shall include at a minimum, all of the following:

1) Activity number and description.
2) Predecessor and successor activity numbers and descriptions.
3) Activity code(s).
4) Schedule and actual/remaining duration for each activity.
5) Earliest start date (by calendar date).
6) Earliest finish date (by calendar date).
7) Actual start date (by calendar date).
8) Actual finish date (by calendar date).
9) Latest start date (by calendar date).
10) Latest finish date (by calendar date).
11) Float days.
12) Monetary value of each activity.
13) Percentage of activity completed and remaining duration for incomplete activities.
14) Cumulative value of Work completed, based on the Contractor's reported portion of activities completed and accepted.

The computer program(s) used in making the mathematical computation shall be capable of compiling the total dollar value of complete and partially complete activities. The program shall also be capable of accepting revised completion dates, as modified by approved time extensions, and re-computing all activity dates and float accordingly.

Each of the following computer outputs shall be required as part of the Baseline Construction Schedule submittal and each revision or Monthly Updated Construction Schedule thereafter as a condition precedent to receipt of progress payments:

1) Activity sort activity number (PDN) from lowest to highest.
2) Activity sort by the amount of total float, then in order of preceding event or activity number.
3) Activity sort by early start, for the next ninety (90) Days, then in order of

preceding event or activity number.

4) Activity sort(s) by organizational responsibility including submittals to the Engineer for all items of material and equipment, the number of shifts, crew sizes of each craft, and construction equipment to accomplish the activity.
5) A sublisting of materials and equipment sorted by Specification Section number. The sublisting of materials and equipment shall include the following activities: preparation of shop drawings, submittal to the Engineer, review by the Engineer, and fabrication, testing, and/or delivery of material and equipment which shall be interfaced with the earliest start date that the material or equipment is to be installed on the Project.

Outputs 1) and 2) above shall show all activities, including restraints, for the duration of the Project.

The Contractor shall also prepare and submit a time-scaled Master Summary Schedule on a single sheet that shows the total Project in approximately twenty-five (25) to one hundred (100) activities, as agreed to by the Contractor and the Engineer. This schedule will accurately summarize the current Baseline Construction Schedule and shall have common events for correlating the two levels of schedule indenture. All Contract milestones shall be shown. The Master Summary Schedule shall be updated monthly.

19-9 APPROVAL OF BASELINE CONSTRUCTION SCHEDULE.

The Contractor shall submit to the Engineer within fifteen (15) Days after approval of the Preliminary Construction Schedule, five (5) color printed copies of each of the following for approval:

1) Baseline Construction Schedule network diagram and Master Summary Schedules.
2) Computer tabulations (copies 8 ½" x 11" in size).
3) Labor Projections and Summary according to Subsection 19-16 (copies 8 ½" x 11" in size).
4) Cash Flow Projections and Summary according to Subsection 19-13 (copies 8 ½" x 11" in size).
5) Equipment Projections and Summary according to Subsection 19-17 (copies 8½" x 11" in size).
6) All required reports specified in Subsections 19-7 and 19-8.
7) Written confirmation of concurrence of all major trade Subcontractors and Suppliers.

The Contractor shall provide to the Engineer, two electronic copies on CD or 3½" DS, HD 1.44 Mb computer disk of all schedules and reports.

The Engineer shall approve or disapprove, in writing, the Contractor's submission within twenty-one (21) Days after receipt of all required information. The Preliminary Construction Schedule, once approved, becomes the Baseline Construction Schedule which shall be used for monitoring and evaluating all facets of Contract performance, including, but not limited to progress, changes, and delays.

The Contractor, the Contractor's Construction Scheduler, and all major Subcontractors and Suppliers shall be required to participate in all meetings necessary to reach mutual agreement and approval of the Baseline Construction Schedule, the Master Summary Schedule, the Labor Requirements Forecast, and the Cash Flow Projection.

The Contractor shall revise the schedule, as required by the Engineer, to reflect Project construction. If any of the required submissions are returned to the Contractor for corrections or revisions, they shall be resubmitted along with two (2) computer diskettes and five (5) printed copies of each change for approval within seven (7) Days after receipt. Resubmittals shall be as required in Subsection 19-9. Review and response by the Engineer shall be given within seven (7) Days after receipt of each new submission.

When submitting the Baseline Construction Schedule for approval, the Contract shall include in its letter of transmittal, any variances from the requirements of the Contract Documents. Otherwise, the Contractor will not be relieved of the responsibility for executing the Work in strict accordance with the requirements of the Contract Documents.

If the Contractor fails to submit the initial Baseline Construction Schedule, the Master Summary Schedule, the Labor Requirements Forecast, the Cash Flow Projection, major Subcontractor and Supplier confirmation in writing, or the computer diskettes, within the time prescribed, or revisions thereof within the required time, it is within the Engineer's discretion to stop the Contractor's Work at no additional cost to the Agency. Further, no mobilization progress payments shall be made until such time as the Contractor submits the required information and obtains approval of the Baseline Construction Schedule.

[PE: If scheduling incentive language in Section 19-3 will be used, delete paragraph below]

Failure of the Contractor to submit the Baseline Construction Schedule or any required resubmittals, in a timely, accurate manner and in accordance with the requirements of this Section will result in costs to the Agency. Therefore, the Contractor shall pay the Agency Liquidated Damages in the amount of $**[_____]** per Day, for every Day the schedule submittal, revision, or resubmittal is late. This amount shall be subtracted from any monies due to the Contractor and shall be forfeited by the Contractor.

19-10 REVISIONS TO APPROVED BASELINE CONSTRUCTION SCHEDULE.

The Contractor shall prosecute the Work in accordance with the approved Baseline Construction Schedule. Out of sequence construction, defined as a change in the Baseline Construction Schedule, requires prior approval of the Engineer as defined below.

Upon approval of a Change Order, a Time and Materials (T&M) Change Order, or a Unilateral Change Order, the change shall be reflected in the next schedule submittal by the Contractor.

No change to the approved Baseline Construction Schedule shall be made without the prior written approval of the Engineer. If the Contractor desires to make a change to the approved Baseline Construction Schedule, the Contractor shall request permission from the Engineer in writing, stating the reasons for the change as well as the specifics, such as revisions to activities, logic, durations, etc. The Engineer will provide a response within seven (7) Days.

If the Engineer considers a schedule change to be of a major nature, the Engineer may require the Contractor to revise and submit for acceptance all of the affected portion(s) of the Baseline Construction Schedule and an analysis to show the effect on the entire Project. The proposed revision and analysis shall be submitted to the Engineer within fifteen (15) Days after the Engineer notifies the Contractor the revision is of a major nature. A change will be considered to be of a major nature if the time estimated for an activity or sequence of activities is varied from the original plan to the degree that there is reasonable doubt that the Contract Completion Date will be met, or if the change impacts the Work of other contractors at the Site. Changes to activities having adequate float shall be considered as minor changes, except that an accumulation of minor changes may be considered a major change when such changes affect the Contract Completion Date. (Activities that have adequate float are activities that are not critical after the change is made.)

Only upon approval of a change by the Engineer shall it be reflected in the next schedule update submitted by the Contractor.

19-11 SCHEDULE UPDATES AND PROGRESS PAYMENTS.

The initial Monthly Updated Construction Schedule shall be submitted within the first week after approval of the Baseline Detailed Project Schedule. The Contractor shall submit subsequent Monthly Updated Construction Schedules to the Engineer for review and approval, five (5) Days before the end of each month throughout the duration of the Project. All updated or revised schedules shall be submitted in the same detail as the Baseline Construction Schedule, unless modified in writing by the Engineer, and shall include written confirmation of the major Subcontractors and Suppliers. The updates shall be cost and resource loaded.

The Baseline Construction Schedule and computer tabulations shall be reviewed jointly by the Contractor's Project Manager and Construction Scheduler and representatives of all major Subcontractors and Suppliers at a joint monthly update meeting with the Engineer and the Inspector for the purpose of verifying all of the following:

1) Actual start dates.
2) Actual completion dates (when an activity is deemed substantially complete by the Engineer, then such activity will no longer be treated as an activity affecting the critical path or successor activities on the project).
3) Cost value of accepted Work reported in place.
4) Activity percent completion.
5) Incorporation of approved changes and approved time extensions.
6) Status of outstanding Notices of Non-Compliance.

The proposed update schedule prepared by the Contractor shall include all information available as of the cutoff date established by the Engineer. A detailed list of all proposed schedule changes (logic, duration, status, additions, and deletions) and revised histograms and tabular reports for labor and construction equipment as required by Subsections 19-16 and 19-17 shall be submitted with the update. Prior to the monthly update review meeting, the Contractor shall obtain from his/her Subcontractors, Suppliers, and staff the necessary information as required to reflect progress to date. A proposed Monthly Update Construction Schedule containing all of the information set forth below shall be available for review at the meeting:

1) For activities started and/or completed during the previous period: Actual start and actual completion dates, number of Days, number of shifts, crew sizes by craft, and construction equipment used to accomplish the activity.
2) For activities begun but not yet complete to date: number of shifts, crew sizes by craft, construction equipment required, remaining duration of the Work, and estimated completion date.
3) For activities not yet started: Estimated start dates, number of shifts, crew sizes by craft, construction equipment required, revised durations, and estimated completion dates, as necessary.
4) For authorized Change Orders: Revised activities, number of shifts, crew sizes by craft, construction equipment required, and durations, where required.
5) The Monthly Updated Construction Schedule shall be for the month preceding the meeting and for the remainder of the Project. The previous month's activities shall be reported as they actually took place and designated as actually complete, if actually completed, on the network diagram update.
6) Portions of the Monthly Updated Construction Schedule on which all activities are complete need not be reprinted and submitted in subsequent updates. However, the electronic disk file of the submitted Monthly Updated Construction Schedule and the related reports shall constitute a clear record of progress of the Work from the Notice to Proceed date to final completion.
7) The Contractor shall provide to the Engineer, printed copies of the Predecessor/Successor Report, a printed list of all changes made to the previously approved Monthly Updated Construction Schedule, and the Schedule Narrative Report.
8) The monthly submittal to the Engineer shall be accompanied by five bound copies of the Schedule Narrative Report. The Schedule Narrative Report shall describe

the physical progress during the report period, plans for continuing the Work during the forthcoming report period, actions planned to correct any negative float predictions, and an explanation of potential delays and/or problems and their estimated impact on performance and the Contract Completion Date. In addition, alternatives for possible schedule recovery to mitigate any potential delay and/or cost increases shall be included for consideration by the Engineer. The bound report shall follow the outline set forth below:

CONTRACTOR'S SCHEDULE NARRATIVE REPORT OUTLINE

1) Contractor's Transmittal Letter
2) Description of problem areas
3) Current and anticipated delays
   a) Cause of the delay
   b) Corrective action and schedule adjustments to correct the delay
   c) Impact of the delay on other activities, milestones, and completion dates
4) Changes in construction sequences
5) Pending items and status thereof
   a) Permits
   b) Change Orders
   c) Time extensions
   d) Non-Compliance Notices
6) Contract Completion Date(s) status
   a) Ahead of schedule and number of Days
   b) Behind schedule and number of Days
7) Other Project or scheduling concerns including any shutdowns, duration of each shutdown, and analysis of any work to be performed during the shutdown period
8) Include reviewed and updated Monthly Updated Construction Schedule and Reports
9) Include revised Cost Loading and Cash Flow Information (Subsection 19-13)
10) Include revised labor information (Subsection 19-16)
11) Include revised construction equipment information (Subsection 19-17)

All network changes and status dates agreed to during each update meeting shall be considered as acceptable by all parties unless written notice of exception is given by an objecting party within three (3) Days after the update meeting. For major network changes that cannot be agreed to during an update meeting, the Contractor shall submit, in writing, such revisions for the Engineer's approval prior to inserting such changes into the Monthly Updated Construction Schedule. Submissions may be in the form of marked-up networks, fragments, or schedule abstracts provided they are submitted with a letter of transmittal. The submission and approval procedures for this information shall follow the same timetable described in Subsection 19-15.

Predicated on the results of the Engineer's review of monthly submissions of schedules and reports, the Contractor may be required to revise the Baseline Construction Schedule. Conditions under which a revision will be made are as follows:

1) When a delay in the completion of any Work item or sequence of Work items results in an indicated extension of the Contract Completion Date or interim milestone dates detailed herein by fifteen (15) Days or more.
2) When delays in submittals or deliveries or Work stoppages are encountered which make replanning, rescheduling, or resequencing of the Work necessary.
3) When the schedule does not represent the actual execution and progress of the Work.

Required revisions of the Monthly Updated Construction Schedules are due within five (5) Days of notice by the Engineer that a revision is required. All revisions and additions to the Baseline Construction Schedule are subject to the review of the Engineer. No changes are to be implemented in the schedule by the Contractor without the prior approval of the Engineer. When the proposed Monthly Updated Construction Schedule or its required revision is approved by the Engineer, it then becomes the Monthly Updated Construction Schedule. The current month's approved Monthly Updated Construction Schedule will be used for the period from which it is approved until its successor is submitted and approved.

Five (5) color copies of the final Schedule Narrative Report, the updated Baseline Construction Schedule (networks, and computer computations), the Master Summary Schedule, the Cash Flow Projection and Summary, the updated Monthly Updated Construction Schedule, updated computer disks reflecting the status of the Project agreed to at the updating meeting, and the Labor Projections and Summary shall be submitted to the Engineer within five (5) Days after each updating meeting in accordance with this Section.

The proposed Monthly Updated Construction Schedule shall show the activities or portions of activities completed during the reporting period and their total value as the basis for the Contractor's periodic request for payment. Payments made pursuant to Subsection 9-3, will be based on the total value of such activities completed or partially completed after verification by the Inspector. The report shall state the percentage of the Work actually completed and scheduled as of the report date and the progress along the critical path in terms of Days ahead or behind the allowable dates. If the Project is behind schedule, progress along other paths with negative float shall also be reported.

[PE: The paragraph below is optional. If used, delete the highlighted incentive language in 19-3 above.]

Failure of the Contractor to submit Monthly Updated Construction Schedule in a timely, accurate manner and in accordance with the requirements of this Section will result in costs to the Agency. Therefore, the Contractor shall pay the Agency Liquidated Damages in the amount of $[ ] per day for every Day the submittal is late or not in full compliance with the requirements of this Section. This amount shall be deducted from any monies due to the Contractor, and forfeited by the Contractor. In addition to the Liquidated Damages, if the Contractor continues to fail to submit any of the update deliverables, or to meet any of the other updating requirements, for a period of thirty (30) Days or more beyond the required submittal

date, progress payments will be withheld until such time as the Contractor submits the required update requirements.

19-12 WEEKLY PROGRESS REPORTS.

Once each week, on a date established by the Engineer, the Contractor shall submit two progress schedules:

1) The first shall be a progress schedule listing the activities completed and in progress for the previous week and the activities scheduled for the succeeding two (2) weeks. The activity designations shall be consistent with the activity designations in the Monthly Updated Construction Schedule. A color bar chart shall be used to display the information in pictorial form.
2) The second shall be a utility work/access alteration report and a schedule listing the activities completed by activity designation from the Monthly Updated Construction Schedule and in progress for the previous week and the activities scheduled for the succeeding four (4) weeks. This report and schedule shall include all Work on utilities and equipment, as well as shutdowns and access alterations.

19-13 CASH FLOW PROJECTIONS AND SUMMARY.

With the Baseline Construction Schedule submittal, each Monthly Updated Construction Schedule, and subsequent revisions, the Contractor shall also submit a schedule of cost loading and cash flow to the Engineer. There shall be a strict correlation between the sum of individual activity costs and the total values indicated for Bid items. That is, each individual activity within the Detailed Project Schedule shall employ a code, which, in summary, attaches its cost, if any, to the appropriate Bid items. The sum of activity costs within a specific code, then, shall equal the cost of its corresponding Bid items and approved Change Orders.

Expected payment requests for each month shall be included with proposed Monthly Updated Construction Schedule, as well as the cumulative payment requests to date for each month of the Project. The net payment requests for each month and the cumulative payment requests to date shall also be shown after deducting retainage and any other monies withheld. The cash flow shall be shown in tabular format and in graphic format.

The Contractor, at the Pre-Construction Scheduling Conference, shall explain in detail the procedure to be used to develop the schedule activity cost loading and Cash Flow Projection and Summary. This procedure is subject to the review and approval of the Engineer and the Inspector. Receipt and approval of the schedule activity resource loading and Cash Flow Projection and Summary methodology is a condition precedent to the making of any payments under the Contract. Therefore, failure to submit an acceptable methodology and Cash Flow Projection and Summary shall be cause for withholding any progress payments due under this Contract.

In accordance with the updating procedures, when an activity is deemed substantially complete by the Engineer, then such activity will no longer be treated as an activity affecting the critical path or successor activities on the Project. The cost of correction of any punchlist items associated with substantially completed activities will be covered by withheld retention or other amounts deemed by the Engineer to be adequate to cover such costs.

19-14 RESPONSIBILITY OF COMPLETION.

Whenever it becomes apparent from a schedule review progress meeting or the current Monthly Updated Construction Schedule that any milestone date(s) or the Contract Completion Date will not be met, the Contractor shall take some or all of the following actions:

1) Increase construction labor in such quantities and crafts as shall substantially eliminate the backlog of Work and meet the current Contract Completion Date.
2) Increase the number of working hours per shift, the number of shifts per day, the number of Working Days per week, or the amount of construction equipment, or any combination of the foregoing sufficient to substantially eliminate the backlog of Work.
3) Reschedule Work items to achieve concurrent accomplishment of Work activities.

Prior to implementing any of the above actions, the Contractor shall notify and obtain approval from the Engineer. If such actions are approved, the Contractor shall incorporate the revisions into the next Monthly Updated Construction Schedule.

Under no circumstances will the addition of equipment or construction forces, increasing the working hours or any other method, manner, or procedure to return to the Contract Completion Date be considered justification for a Change Order or be treated as acceleration where the need for a recovery schedule has been caused by the Contractor and/or its Subcontractors or Suppliers, at any tier.

The Engineer may elect to withhold progress payments until the Contractor's progress indicates that the milestone date(s) and/or the Contract Completion Date will be met.

19-15 SCHEDULE TIME EXTENSIONS.

When Change Orders or delays are experienced by the Contractor and a time extension is requested, the Contractor shall submit to the Engineer, a written Time Impact Analysis illustrating the influence of each change or delay on the current Contract schedule Completion Date utilizing the approved Monthly Updated Construction Schedule. Each Time Impact Analysis shall include a fragnet demonstrating how the Contractor proposes to incorporate the Change Order or delay into the Monthly Updated Construction Schedule. A fragnet is defined as a sequence of new and/or activity revisions that are proposed to be added to the approved Baseline Construction Schedule or Monthly Updated Construction Schedule in effect at the time

the change or delay is encountered to demonstrate the influence of the delay and the method for incorporating the delay and its impact into the schedule as they are encountered.

Each Time Impact Analysis shall demonstrate the estimated time impact based on the date of the event, the date the proposed change and Change Order(s) were given to the Contractor, the status of construction at that point in time, and the event time computation of all activities affected by the change or delay and its impact on the Baseline Construction Schedule. The event times used in the Time Impact Analysis shall be those included in the latest update of the Monthly Updated Construction Schedule, in effect at the time the change or delay was encountered.

Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total or remaining float along the critical path of activities at the time of actual delay, or at the time the proposed change and Change Order(s) were issued. Float or slack time is not for the exclusive use or benefit of the Agency or the Contractor but is an expiring resource available to all parties as needed to meet Contract milestones and the Contract Completion Date. Time extensions shall not be granted nor delay damages paid until both of the following occur:

1) A delay occurs which is beyond the control and without the fault or negligence of the Contractor and its Subcontractors or Suppliers, at any tier.
2) The delay extends actual performance of the Work beyond the applicable current Contract Completion Date and the most recent date predicted for completion of the Project on the approved schedule update current as of the time of the delay or as of the time of issuance of the proposed change and Change Order(s).

Each Time Impact Analysis shall be submitted in triplicate, within fifteen (15) Days after a delay occurs, or issuance of the proposed change and Change Order(s). If the Contractor does not submit a Time Impact Analysis for a specific Change Order or delay within the specified period of time, the Contractor shall be deemed to have irrevocably waived any rights to additional time and cost.

Since float time within the Baseline Construction Schedule and Monthly Updated Construction Schedule is jointly owned it is acknowledged and agreed by the Contractor that Agency-caused delays on the Project may be offset by Agency-caused time savings (including, but not limited to: critical path submittals returned in less time than allowed for in the Contract, approval of Substitution requests which result in a savings of time along the critical path for the Contractor, etc.). In such an event the Contractor shall not be entitled to receive an extension of time or delay damages until all Agency-caused time savings are exceeded and the Contract Completion Date also exceeded.

Approval or rejection of each Time Impact Analysis by the Engineer shall be made within fifteen (15) Days after receipt of each Time Impact Analysis, unless subsequent meetings and negotiations are necessary. Upon approval, a copy of a Time Impact Analysis signed by the Engineer shall be returned to the Contractor for incorporation into the schedule.

Upon mutual agreement by both parties, fragnets illustrating the influence of Change Orders and delays shall be incorporated into the Baseline Construction Schedule or Monthly Updated Construction Schedule during the first update after agreement is reached.

In the event the Contractor does not agree with the decision of the Engineer regarding the impact of a change or delay, it shall be resolved in accordance with Section 3.

19-16 LABOR PROJECTIONS AND SUMMARY.

The Contractor shall submit with the initial Baseline Construction Schedule a histogram depicting total Project craft labor and craft labor for its own forces and for each of its Subcontractors for each month. The histogram shall be based upon and shall be in substantive agreement with the number of shifts and crew sizes by craft in the Baseline Construction Schedule and shall be updated monthly and submitted with the monthly progress report. The update shall show actual labor for each month during the construction period to date and required labor for both base scope and Change Order Work each month necessary to complete all remaining activities, including Change Order Work, to insure timely Project completion.

19-17 EQUIPMENT PROJECTIONS AND SUMMARY.

The Contractor shall submit with the initial Baseline Construction Schedule a tabular report listing each major piece of construction equipment and each major piece of construction equipment for each of its Subcontractors for each month. Each major piece of the Contractor's and the Subcontractor's equipment shall be separately described, identified, and numbered in the report. The tabular report shall be based upon and in substantive agreement with the number of shifts and crew sizes by craft in the Baseline Construction Schedule and shall be updated monthly and submitted with the monthly progress report. The update shall show actual construction equipment for each month during the construction period to date and required construction equipment for each month necessary to complete all remaining activities, including Change Order Work, on the early finish date.

19-18 MEASUREMENT AND PAYMENT.

Submitting and maintaining the construction schedule and reports required under this specification is considered incidental to other bid items, and no separate payment will be made.

END OF SECTION 19

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SECTION 20 – NUCLEAR GAUGES (FAA 120)

20-1 GENERAL

This section covers the use of nuclear gauges for material testing.

SECTION 120
NUCLEAR GAGES

120-01 TESTING. When the specifications provide for nuclear gage acceptance testing of material for Items P-152, P-154, P-208, and P-209, the testing shall be performed in accordance with this section. At each sampling location, the field density shall be determined in accordance with ASTM D 2922 using the Direct Transmission Method. The nuclear gage shall be calibrated in accordance with Annex A1. Calibration and operation of the gage shall be in accordance with the requirements of the manufacturer. The operator of the nuclear gage must show evidence of training and experience in the use of the instrument. The gage shall be standardized daily in accordance with ASTM D 2922, paragraph 8.

Use of ASTM D 2922 results in a wet unit weight, and when using this method, ASTM D 3017 shall be used to determine the moisture content of the material. The moisture gage shall be standardized daily in accordance with ASTM D 3017, paragraph 7.

The material shall be accepted on a lot basis. Each Lot shall be divided into eight (8) sublots when ASTM D 2922 is used.

120-02. When PWL concepts are incorporated, compaction shall continue until a PWL of 90 percent or more is achieved using the lower specification tolerance limits (L) below.

The percentage of material within specification limits (PWL) shall be determined in accordance with the procedures specified in Section 13 (FAA 110) of these specifications. The lower specification tolerance limit (L) for density shall be:

Specification Item Number	*Specification Tolerance (L) for Density, (percent of laboratory maximum)*
Item P-152	*90.5 for cohesive material,* *95.5 for non-cohesive*
Item P-154	*95.5*
Item P-208	*97.0*
Item P-209	*97.0*

If the PWL is less than 90 percent, the lot shall be reworked and recompacted by the Contractor at the Contractor's expense. After reworking and recompaction, the lot shall be resampled and retested. Retest results for the lot shall be reevaluated for acceptance. This procedure shall continue until the PWL is 90 percent or greater.

120-03 VERIFICATION TESTING. (For FAA Items P-152 and P-154 only.) The Engineer will verify the maximum laboratory density of material placed in the field for each lot. A minimum of one test will be made for each lot of material at the site. The verification process will consist of; (1) compacting the material and determining the dry density and moisture-density in accordance with ASTM D 1557, and (2) comparing the result with the laboratory moisture-density curves for the material being placed. This verification process is commonly referred to as a "one-point Proctor". If the material does not conform to the existing moisture-density curves, the Engineer will establish the laboratory maximum density and optimum moisture content for the material in accordance with ASTM D 1557.

Additional verification tests will be made, if necessary, to properly classify all materials placed in the lot.

The percent compaction of each sampling location will be determined by dividing the field density of each sublot by the laboratory maximum density for the lot.

END OF SECTION 120

20-2 METHOD OF MEASUREMENT

Use of nuclear gauges will not be measured for payment

20-3 BASIS OF PAYMENT

Use of nuclear gauges, if approved by the Engineer, will be considered incidental to the bid items for which they are utilized and no separate payment will be made.

END OF SECTION 20

Black text – from standard FAA spec	Blue text – Additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – Notes to the Engineer won't appear in spec

1.1 DESCRIPTION

A. General

1. Preparation of existing pavement surface for overlay
2. Removal of existing pavement
3. Miscellaneous items

B. In accordance with specifications and drawings

1.2 EQUIPMENT

A. Shall be approved by the Engineer.

B. Shall not cause damage to pavement to remain.

1.3 CONSTRUCTION METHODS

A. Removal of existing pavement.

1. Portland Cement Concrete Pavement (PCC)
   a. See Section [ ] of these specifications, Concrete Removal, Repair and Replacement
2. Asphaltic Concrete (AC) Pavement
   a. Cut to full depth around perimeter to be removed
   b. Remove in such a manner that joints in overlay will be offset at least 1 ft from joint in underlying layer.
      (1) Does not apply if removed material to be replaced with concrete or soil.
   c. Remove material from airport, dispose of legally, unless otherwise specified

B. Preparation of joints and cracks.

1. Prior to Asphaltic overlay:
   a. From all joints and cracks remove:
      (1) Sealant.
         i. Also remove excess sealant from pavement surface as well as joints
      (2) Debris.
      (3) Vegetation.
         i. Apply soil sterilant.
   b. From cracks and joints larger than 3/8 inch width:
      (1) Fill with mixture of emulsified asphalt and aggregate:
         i. Aggregate:
            (a) Limestone, volcanic ash, sand or other.
            (b) Combined gradation as in Table 1:

Table 1	
Sieve Size	Percent Passing
No. 4	100
No. 8	90-100

No. 16	65-90
No. 30	40-60
No. 50	25-42
No. 100	15-30
No. 200	10-20

ii. Up to 3% cement to accelerate set time allowed.
iii. Mix shall not contain more than 20% Natural Sand.
iv. Portions of Aggregate and asphalt to be field-determined.
(a) Approximate portions, by volume:
• One part asphalt emulsion.
• Five parts aggregate.
(b) Proportions may be field-varied to facilitate construction.
v. Pour into crack and compact.
vi. Fill to within 1/8 inch of surface.
vii. Remove spills or excess prior to overly.

(2) Fill with proprietary crack fill material:
i. [Name Product] or approved equal conforming to.
ii. [Name ASTM tests or other specific requirements].
iii. Apply per manufacturer's instructions.

2. Prior to concrete overlay need remove only:

a. Excess joint material on surface.
b. Vegetation.

C. Removal of paint and rubber.

1. Remove paint and rubber:

a. Over 1 ft wide and.
b. That may affect bond.

2. Methods:

a. High pressure water.
~~b. Heater scarifier (ac pavement).~~
c. Cold milling.
d. Sandblasting.
e. Method must not cause damage over 1/8-inch deep.
f. Any chemicals must comply with state's environmental requirements.
g. Remove wastes from the airport and dispose of legally.
h. This spec not to be used for paint removal for skid improvement.

D. Concrete spall or failed asphaltic concrete pavement repair.

1. Repair of Concrete Spalls in Areas to be overlaid with Asphalt:

a. Saw perimeter of the repair a minimum of 1 inch deep
b. Remove material:
(1) To depth where existing material is firm
i. Cannot be easily removed with a geologist pick.
c. Fill with asphaltic concrete:
(1) Minimum Marshall stability of 1,200 lbs
(2) Maximum flow of 20.
(3) Maximum lift thickness 4 inches.

d. Compact with Engineer-approved equipment
   (1) Until the material is dense and no movement or marks can be noted.
e. This method of repair applies only to pavement to be overlaid.
   (1) See Section [ ], Concrete Removal, Repair and Replacement for concrete spall repair in other situations

2. Asphaltic Concrete Repair in Areas to be overlaid:

a. Remove material as specified in D.1.b.
b. Remove all failed material including:
   (1) Surface
   (2) Base
   (3) Subbase
   (4) Subgrade
c. If infiltrated with clay, silt or other material, replace base and subbase, with materials and methods in sections Sections [ ] Crushed Aggregate Base course, and [ ], Aggregate Subbase, of these specifications.
d. Reworking of subgrade shall be measured for payment under Section [ ], Earthwork.

E. Cold Planing

1. Patching

a. Machine must be capable of making vertical cut w/o chipping/spalling.
b. Engineer shall ~~layout~~ approve areas to be milled.
c. Layout with straightedge in increments of 1-ft.
d. Mill only failed area unless otherwise specified.
   (1) Area milled outside approved limits will not be measured for payment.

2. Profiling, Grade Correction or Surface Correction

a. Equipment
   (1) Shall have minimum width 10 ft.
   (2) Shall have electronic grade control.
   (3) Shall cut vertical edges.
   (4) Shall have positive method of dust control.
   (5) Shall discharge millings into:
      i. Truck.
      ii. Defined windrow.

1.4 SUBMITTAL REQUIREMENTS

A. Proposed equipment

B. Proposed method of paint/rubber removal

C. Crack filling materials

1. Aggregate

2. Bitumen

3. Proprietary Materials

1.5 METHOD OF MEASUREMENT

A. General

1. If no quantity shown on bid schedule, work shall be considered incidental to other work and no measurement for payment will be made.
2. If quantities shown on bid schedule, work shall be measured for payment as follows:

B. Pavement removal

1. Pavement removal shall be measured for payment under Section [ ] of these specifications, Removals.

C. Joint and crack repair

1. Per linear foot

D. Paint and rubber removal

1. Per square foot

E. Concrete spall repair

1. Per square foot
2. Average depth ~~to be agreed between Engineer/Contractor~~ is assumed to be [ ].
3. No additional payment for variations in thickness
4. Only for repairs to pavement prior to overlay. See Section [ ], Concrete Removal, Repair and Replacement for other spall repair.

F. Repair of failed asphalt pavement

1. Per square yard
2. Average depth ~~to be agreed between Engineer/Contractor~~ is assumed to be [ ].
3. No additional payment for variations in thickness
4. Replacement of base course, subbase course, subgrade preparation shall be measured and paid under Sections [ ] Aggregate Subbase Course, [ ] Crushed Aggregate Base Course, and [ ] Earthwork, of these specifications.

G. Cold Planing

1. Per square yard
2. Average depth ~~to be agreed between Engineer/Contractor~~ is assumed to be [ ].
3. No additional payment for variations in thickness.
4. Contractor shall replane at his own expense if initial cut does not correct condition.

1.6 BASIS OF PAYMENT

A. Paid at contract unit price under Item Number

1. 21.1 Joint and Crack Repair– per linear foot
2. 21.2 Paint and Rubber Removal – per square foot
3. 21.3 Concrete Spall Repair – per square foot
4. 21.4 Repair of Failed Asphalt Pavement – per square yard
5. 21.5 Cold Planing – per square yard

6. 21.6 Is full compensation for all labor, equipment, tools and incidentals.
7. No separate payment for work in areas of night or limited-time construction area.

END OF SECTION

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
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I. DESCRIPTION

A. GENERAL

1. Preparation of existing pavement surface for overlay
2. Removal of existing pavement
3. Miscellaneous items

B. In accordance with specifications and drawings

II. EQUIPMENT

A. Shall be approved by the Engineer.

B. Shall not cause damage to pavement to remain.

III. CONSTRUCTION METHODS

A. REMOVAL OF EXISTING PAVEMENT

1. Portland Cement Concrete Pavement (PCC)
   a) See Section [ ] of these specifications, Concrete Removal, Repair and Replacement
2. Asphaltic Concrete (AC) Pavement
   a) Cut to full depth around perimeter to be removed
   b) Remove in such a manner that joints in overlay will be offset at least 1 ft from joint in underlying layer.
      (1) Does not apply if removed material to be replaced with concrete or soil.
   c) Remove material from airport, dispose of legally, unless otherwise specified

B. PREPARATION OF JOINTS AND CRACKS

1. Prior to Asphaltic overlay:
   a) From all joints and cracks remove:
      (1) sealant
         (a) also remove excess sealant from pavement surface as well as joints
      (2) debris
      (3) vegetation
         (a) Apply soil sterilant
   b) From cracks and joints larger than 3/8 inch width:
      (1) Fill with mixture of emulsified asphalt and aggregate:
         (a) Aggregate:
            (i) limestone, volcanic ash, sand or other
            (ii) combined gradation as in Table 1:

Table 1	
Sieve Size	Percent Passing
No. 4	100
No. 8	90-100
No. 16	65-90
No. 30	40-60
No. 50	25-42
No. 100	15-30
No. 200	10-20

         (b) Up to 3% cement to accelerate set time allowed.
         (c) Mix shall not contain more than 20% Natural Sand

(d) Portions of Aggregate and asphalt to be field-determined
(i) Approximate portions, by volume:
(a) One part asphalt emulsion
(b) Five parts aggregate
(ii) Proportions may be field-varied to facilitate construction
(e) Pour into crack and compact
(f) Fill to within 1/8 inch of surface
(g) Remove spills or excess prior to overly
(2) Fill with proprietary crack fill material:
(a) [Name Product] or approved equal conforming to
(b) [Name ASTM tests or other specific requirements]
(c) Apply per manufacturer's instructions

2. Prior to concrete overlay need remove only:
a) Excess joint material on surface
b) Vegetation

C. REMOVAL OF PAINT AND RUBBER
1. Remove paint and rubber:
a) over 1 ft wide and
b) that may affect bond
2. Methods:
a) high pressure water
~~b) heater scarifier (AC pavement)~~
c) cold milling
d) sandblasting
e) method must not cause damage over 1/8-inch deep
f) any chemicals must comply with State's environmental requirements
g) remove wastes from the airport and dispose of legally
h) This spec not to be used for paint removal for skid improvement.

D. CONCRETE SPALL OR FAILED ASPHALTIC CONCRETE PAVEMENT REPAIR
1. Repair of Concrete Spalls in Areas to be overlaid with Asphalt:
a) Saw perimeter of the repair a minimum of 1 inch deep
b) Remove material:
(1) To depth where existing material is firm
(a) cannot be easily removed with a geologist pick.
c) Fill with asphaltic concrete:
(1) minimum Marshall stability of 1,200 lbs
(2) maximum flow of 20.
(3) Maximum lift thickness 4 inches.
d) Compact with Engineer-approved equipment
(1) Until the material is dense and no movement or marks can be noted.
e) This method of repair applies only to pavement to be overlaid.
(1) See Section [ ], Concrete Removal, Repair and Replacement for concrete spall repair in other situations
2. Asphaltic Concrete Repair in Areas to be overlaid:
a) Remove material as specified in D.1.b.
b) Remove all failed material including:
(1) surface
(2) base
(3) subbase
(4) subgrade
c) If infiltrated with clay, silt or other material, replace base and subbase, with materials and methods in sections Sections [ ] Crushed Aggregate Base course, and [ ],

Aggregate Subbase, of these specifications.

d) Reworking of subgrade shall be measured for payment under Section [ ], Earthwork.

E. COLD PLANING

1. Patching
   a) Machine must be capable of making vertical cut w/o chipping/spalling.
   b) Engineer shall ~~layout~~ approve areas to be milled.
   c) Layout with straightedge in increments of 1-ft.
   d) Mill only failed area unless otherwise specified.
      (1) Area milled outside approved limits will not be measured for payment.
2. Profiling, Grade Correction or Surface Correction
   a) Equipment
      (1) Shall have minimum width 10 ft.
      (2) Shall have electronic grade control
      (3) Shall cut vertical edges
      (4) Shall have positive method of dust control
      (5) Shall discharge millings into
         (a) Truck
         (b) Defined windrow

IV. SUBMITTAL REQUIREMENTS

A. PROPOSED EQUIPMENT
B. PROPOSED METHOD OF PAINT/RUBBER REMOVAL
C. CRACK FILLING MATERIALS
   1. Aggregate
   2. Bitumen
   3. Proprietary Materials

V. METHOD OF MEASUREMENT

A. GENERAL
   1. If no quantity shown on bid schedule, work shall be considered incidental to other work and no measurement for payment will be made.
   2. If quantities shown on bid schedule, work shall be measured for payment as follows:

B. PAVEMENT REMOVAL
   1. Pavement removal shall be measured for payment under Section [ ] of these specifications, Removals.

C. JOINT AND CRACK REPAIR
   1. per linear foot

D. PAINT AND RUBBER REMOVAL
   1. per square foot

E. CONCRETE SPALL REPAIR
   1. per square foot
   2. average depth ~~to be agreed between Engineer/Contractor~~ is assumed to be [ ].
   3. No additional payment for variations in thickness
   4. Only for repairs to pavement prior to overlay. See Section [ ], Concrete Removal, Repair and Replacement for other spall repair.

F. REPAIR OF FAILED ASPHALT PAVEMENT
   1. per square yard
   2. average depth ~~to be agreed between Engineer/Contractor~~ is assumed to be [ ].
   3. No additional payment for variations in thickness
   4. Replacement of base course, subbase course, subgrade preparation shall be measured and paid under Sections [ ] Aggregate Subbase Course, [ ] Crushed Aggregate Base Course, and [ ] Earthwork, of these specifications.

G. COLD PLANING
1. per square yard
2. average depth ~~to be agreed between Engineer/Contractor~~ is assumed to be [ ].
3. No additional payment for variations in thickness.
4. Contractor shall replane at his own expense if initial cut does not correct condition.

VI. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
1. 21.1 Joint and Crack Repair– per linear foot
2. 21.2 Paint and Rubber Removal – per square foot
3. 21.3 Concrete Spall Repair – per square foot
4. 21.4 Repair of Failed Asphalt Pavement – per square yard
5. 21.5 Cold Planing – per square yard
6. 21.6 Is full compensation for all labor, equipment, tools and incidentals.
7. No separate payment for work in areas of night or limited-time construction area.

VII. END OF SECTION

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
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I. DESCRIPTION

A. GENERAL

1. This section applies only to areas specifically identified on plans for Clearing and Grubbing.
2. Stripping of sod from top two inches of other excavation areas shall be measured and paid as Unclassified Excavation under Section [ ], Earthwork.
3. In conformance with the plans and specifications.

B. CLEARING AND GRUBBING, INCLUDES:

1. Clearing ground surface of:
   a) trees, stumps, down timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences, structures, debris, and rubbish
   b) any natural material unsuitable for foundation of construction
2. Grubbing of
   a) stumps, roots, matted roots, foundations
3. Legal disposal off the airport

II. CONSTRUCTION METHODS

A. GENERAL

1. Area to be staked ~~by the Engineer~~ by the Contractor, and approved by the Engineer.
2. Spoil materials
   a) Shall be removed from the airport and disposed of legally.
   b) Burning prohibited.
   c) Broken concrete or masonry may be incorporated into fills if conforming to the requirements of Section [ ] Earthwork.
   d) May be temporarily stockpiled only where approved by the Engineer.
3. Blasting not allowed.

~~B. CLEARING~~

C. CLEARING AND GRUBBING

1. Remove stumps, roots, buried logs, brush, grass, and other unsatisfactory materials except where
   a) Area will be
      (1) outside paved areas
      (2) more than 3-1/2 feet below top of finished subgrade:
         (a) sound trees, stumps, brush can remain within 6 inches of remaining ground surface
2. Tap roots greater than 1-1/2 inch diameter:
   a) Grub to depth of 18 inches below finished subgrade
3. Remove buildings and miscellaneous structures in conformance with Section [ ], Removals.
4. Holes remaining:
   a) Break down vertical sides
   b) Fill and compact with select material in accordance with Section [ ], Earthwork.

III. SUBMITTAL REQUIREMENTS

A. Proof of intended legal disposal site.

IV. METHOD OF MEASUREMENT

A. CLEARING AND GRUBBING

1. per acre
2. measured to nearest 1/10 acre.

V. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER

1. 22.1 Clearing and Grubbing - per acre
2. Is full compensation for all materials, labor, equipment, tools and incidentals.
3. No separate payment for work in areas of night or limited-time construction area.

VI. TESTING REQUIREMENTS

A. ASTM D 698 MOISTURE-DENSITY RELATIONS OF SOILS AND SOIL-AGGREGATE MIXTURES USING 5.5 LB (2.49 KG) RAMMER AND 12-IN. (305 MM) DROP

B. ASTM D 1556 DENSITY OF SOIL IN PLACE BY THE SAND-CONE METHOD

C. ASTM D 2922 DENSITY OF SOIL IN PLACE BY THE NUCLEAR DENSITY METHOD

D. AASHTO T 26 QUALITY OF WATER TO BE USED IN CONCRETE

VII. MATERIAL REQUIREMENTS

A. ASTM C 977 QUICKLIME AND HYDRATED LIME FOR SOIL STABILIZATION

VIII. END OF SECTION

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I. DESCRIPTION

A. GENERAL
1. Excavation, embankment, preparation of subgrade.
2. In conformance with the plans and specifications

II. CLASSIFICATION

A. UNCLASSIFIED
1. All material shall be considered "unclassified excavation" unless otherwise noted

~~B. ROCK EXCAVATION~~

~~C. MUCK EXCAVATION~~

D. DRAINAGE EXCAVATION
1. For Ditch excavation only.
2. Excavation for drainage and utility pipes and structures will be included in cost of those items

E. BORROW EXCAVATION
1. Contractor-provided (from off the project site) material for embankment construction

F. UNSUITABLE EXCAVATION
1. Material containing vegetable or organic material
   a) Not to be used in constructed fills
   b) May be used on tops of fills where seeding required.

G. SELECT/SUITABLE MATERIAL
1. Maximum particle size: 3 inches
2. Maximum percent passing the #200 Screen: 25%
3. Maximum Liquid Limit (LL): 35
4. Maximum Plasticity Index (PI): 12
5. Measured and paid as unclassified excavation unless otherwise specified.

H. SUBGRADE PREPARATION
1. Scarification and recompaction of top of subgrade layer
2. Thickness as shown on plans
3. Separate payment item.

III. CONSTRUCTION METHODS

A. GENERAL
1. Clear and Grub per P-151 if required by plans
   a) Suitability of excavated material for embankment (fill) will be subject to approval by Engineer
2. Unsuitable material to disposed of:
   (1) Legally off the airport unless otherwise directed by the Engineer
   (2) Disposal on the airport, where so directed, shall be graded to provide positive drainage
3. If historical or archaeological artifacts found
   a) Discontinue work
   b) Preserve artifacts
   c) Will be considered Extra Work
4. Outside pavement areas, where soil becomes compacted by construction operations, scarify top 4 inches to loosen soil.
5. If earthwork operations interrupt surface drainage, or drainage courses, conduits or underground structures, Contractor shall:
   a) Notify the Engineer

b) Preserve or provide temporary drainage services.
c) Bear the cost of repairs of damage to drainage structures.

B. EXCAVATION / SUBGRADE PREPARATION

1. General
   a) No excavation until Engineer has approved staking and Engineer has surveyed elevations.
   b) Suitable excavation to be used in construction of embankments (fills).
   c) Excess suitable, and all unsuitable, material to be disposed of legally off the airport unless otherwise specified.
   d) Maintain grade to drain
   e) Intercept with temporary drains or ditches if necessary
   f) Blasting not permitted.
2. Selective Grading
   a) Where Select Material is required (such as utility or structure backfill), Contractor shall stockpile material identified by the Engineer
3. Undercutting
   a) Undercut rock, shale, unstable sand or other unsuitable, by minimum of 12 inches or as directed by the Engineer.
   b) Paid as unclassified excavation
   c) Refill with Select Material and compact as specified in Table 1.
4. Overbreak
   a) Material removed beyond plan limits
      (1) Not paid if avoidable.
      (2) If avoidable, paid as unclassified excavation.
5. Subgrade Compaction Requirements in Excavation/Subgrade Preparation Areas:
   a) General
      (1) Maximum Density to be determined per ASTM:
         (a) Expansive Materials – ASTM D 698.
         (b) For Materials with >30% retained on ¾-inch screen:
            (i) AASHTO T-99
            (ii) AASTO T-180
         (c) All other materials:
            (i) D 1557 – over 60,000# aircraft
            (ii) D 695 – under 60,000# aircraft
      (2) Field Density per:
         (a) ASTM D 1556 or
         (b) ASTM D 2167
         (c) No stones > 4 inches within top 6 inches.
         (d) Complete finished grading at least 1,000 ft ahead of paving operations
      (3) Moisture Content:
         (a) Compact within +/- 2% optimum.
      (4) Use of Nuclear Gauges for Subgrade Compaction
         (a) If allowed, calibrate for moisture content per ASTM D2922.
         (b) See Section [20] of these Specifications for additional requirements re: use of nuclear gauges.
      (5) Moisture – Density Testing Frequency and Acceptance:
         (a) Before and after compaction
         (b) Every 1,000 cubic yards per layer
   b) Compaction Requirements for Subgrade under areas to be paved:
      (1) Compact to depth below top of subgrade and to density per Table 1:

TABLE 1 – SUBGRADE COMPACTION REQUIREMENTS

NON-COHESIVE SOILS (PI < 3) Depth of Compaction, inch				*COHESIVE SOILS (PI ≥3) Depth of Compaction, inch*			
100%	*95%*	*90%*	*85%*	*95%*	*90%*	*85%*	*80%*
x	*x-x*	*xx-xx*	*xx-xx*	*x*	*x-x*	*xx-xx*	*xx-xx*

(NOTES TO THE ENGINEER: : include ONLY most demanding row/column for specific project):

TABLE 1 – SUBGRADE COMPACTION REQUIREMENTS									
GEAR TYPE	GROSS WEIGHT Lb.	NON-COHESIVE SOILS Depth of Compaction, inch				COHESIVE SOILS Depth of Compaction, inch			
		100%	95%	90%	85%	95%	90%	85%	80%
S	30,000	8	8-18	18-32	32-44	6	6-9	9-12	12-17
	50,000	10	10-24	24-36	36-48	6	6-9	9-16	16-20
	75,000	12	12-30	30-40	40-52	6	6-12	12-19	19-25
D (incls. 2S)	50,000	12	12-28	28-38	38-50	6	6-10	10-17	17-22
	100,000	17	17-30	30-42	42-55	6	6-12	12-19	19-25
	150,000	19	19-32	32-46	46-60	7	7-14	14-21	21-28
	200,000	21	21-37	37-53	53-69	9	9-16	16-24	24-32
2D (incls. B757, B767, A-300, DC-10-10, L1011)	100,000	14	14-26	26-38	38-49	5	6-10	10-17	17-22
	200,000	17	17-30	30-43	43-56	5	6-12	12-18	18-26
	300,000	20	20-34	34-48	48-63	7	7-14	14-22	22-29
	400,000 – 600,000	23	23-41	41-59	59-76	9	9-18	18-27	27-36
2D/D1, 2D/2D1 (incls. MD11, A340, DC10-30/40)	500,000 – 800,000	23	23-41	41-59	59-76	9	9-18	18-27	27-36
2D/2D2 (incls. B747 series)	800,000	23	23-41	41-59	59-76	9	9-18	18-27	27-36
	975,000	24	24-44	44-62	62-78	10	10-20	20-28	28-37
3D (incls. B777 series)	550,000	20	20-36	36-52	52-67	6	6-14	14-21	21-29
	650,000	22	22-39	39-56	56-70	7	7-16	16-22	22-30
	750,000	24	24-42	42-57	57-71	8	8-17	17-23	23-30
2D/3D2 (incls. A380 series)	1,250,000	24	24-42	42-61	61-78	9	9-18	18-27	27-36
	1,350,000	25	25-44	44-64	64-81	10	10-20	20-29	29-38

6. Removal of Utilities
   a) To be done by others unless otherwise shown on plans.
   b) Remove all foundations to 2 ft below top of subgrade.
      (1) Backfill with Select Material and compact per this Table 1.

C. BORROW EXCAVATION
1. If not from within project limits, identify source at least 15 days prior.
2. Make vertical cuts to expose strata.
3. Leave in drainable, neat condition.

D. DRAINAGE EXCAVATION (DITCH EXCAVATION ONLY)
1. Construct intercepting ditches first.
2. Maintain to cross-section and clear of debris.
3. Select Material may be used as fill elsewhere on the project.
4. Unsuitable material disposed of legally off the airport.

E. PREPARATION OF EMBANKMENT AREA
1. Clear and/or grub and scarify to 6 inch depth.

2. Compact per paragraph F.6
3. If slopes >3:1, bench as per plans.
4. Blade surfaces to provide drainage.

F. FORMATION OF EMBANKMENTS

1. Maximum layer thickness 8 inches loose depth.
2. Do not incorporate brush, organics.
3. Suspend operations for rain or other unsatisfactory site conditions.
4. Material in each lift to be within +/- 2% optimum moisture before compaction.
5. Sprinkle/ manipulate as necessary to obtain moisture content.
6. Compaction Requirements in Embankment/Fill Areas:
   a) Embankment/Fill Compaction Requirements under areas to be paved :
      (1) See Table 1, above.
   b) Embankment/Fill Compaction Requirements outside areas to be paved :
      (1) Non-cohesive – 95%
      (2) Cohesive – 90%
      (3) No compaction required on top 4 inches.
7. Test for moisture/density:
   a) Before and after compaction
   b) Every 1,000 cubic yards per layer
8. Modify procedures as necessary based on test results.
9. Keep compacted areas separate.
10. Layer compaction must be approved prior to placing next higher layer.
11. Route construction traffic over constructed area to provide additional compaction.
   a) Empty and loaded trucks.
   b) Distribute traffic evenly.
12. Begin construction at deepest portion of embankment.
13. Construct layers approximately parallel to finished surface.
14. If excavation includes both soil and rock:
   a) Incorporation of rock into outer portions of embankment is acceptable.
   b) No rock > 4 inches in top 6 inches of fill.
   c) Construct rockfill in layers.
   d) Make every effort to fill voids with finer material.
   e) Dispose of excess rock as directed by the Engineer.
   f) If large rock pieces predominately larger than 8 inch, layer thickness may be increased to 2 feet, but only if greater than 4 ft below top of finished subgrade.
15. No separate payment for embankment/fill:
   a) Unless otherwise specified.
   b) Incidental to excavation.

G. FINISHING AND PROTECTING SUBGRADE

1. Remove Any soft or yielding areas:
   a) Fill with Select Material and compact per Table 1.
2. Grade surface to drain readily
3. Protect compacted subgrade from damage.
4. Prior to subbase/base construction:
   a) Ruts and rough spots to be smoothed and recompacted
   b) Subgrade to be approved by the Engineer

H. HAUL

1. Considered incidental and no separate payment to be made.

I. TOLERANCES

1. Areas where base/subbase to be placed:
   a) Smoothness: ½ inch tested with 16 ft straightedge.
   b) Grade: +/0.05 from plan grade.
2. Safety Areas, intermediate and other designated areas:

a) Grade: +/0.10 from plan grade.
b) No smoothness requirement.

3. Correct by reshaping and recompacting.

IV. TOPSOIL [OPTIONAL – BASED ON FAA T-905 - INCLUDE ONLY IF REQUIRED FOR PROJECT]

1. If specified, shall be salvaged from project stripping or grading operations.
   a) May be stockpiled only in areas approved by the Engineer.
2. Topsoil
   a) No admixture of refuse or material toxic to plant growth
   b) Reasonably free of stumps, roots, etc. larger than 2 inches.
   c) pH range of 5.5 to 7.6
   d) Organic content 3% to 20% determined be wet-combustion (chromic acid reduction).
   e) No more than 20% passing #200 sieve per ASTM C 117.
   f) Natural topsoil may be amended to meet above requirements.
   g) Provide source and samples within 10 days of bid acceptance.
3. Preparation
   a) Loosen with disc or harrows minimum depth 2 inches
   b) Clear surface of stones > 2 inches.
4. Placing
   a) Place to uniform depth of 2 inches, unless otherwise specified.
   b) Spread only when surface is dry.
5. Topsoil shall be considered unclassified excavation for purposes of payment.
6. No additional payment for stockpiling or secondary handling or amending.

V. SUBMITTAL REQUIREMENTS

A. QUALITY TESTING FOR:
   1. Select material
   2. Topsoil
B. PROOF OF LEGAL DISPOSAL FOR WASTE MATERIALS.

VI. METHOD OF MEASUREMENT

A. UNCLASSIFIED EXCAVATION
   1. per cubic yard
   2. Measured by average end area method
B. DRAINAGE EXCAVATION
   1. per cubic yard
   2. Measured by average end area method
C. SUBGRADE PREPARATION
   1. per square yard
D. OTHER

VII. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE ITEM NUMBER
   1. 32.1 Unclassified Excavation – per cubic yard
   2. 32.2 Subgrade Preparation – per square yard
   3. 32.3 [Other] – per [ ]
   4. Is full compensation for all materials, labor, equipment, tools and incidentals.
   5. No separate payment for work in areas of night or limited-time construction area.

VIII. TESTING REQUIREMENTS

A. ASTM D 698 MOISTURE-DENSITY RELATIONS OF SOILS AND SOIL-AGGREGATE MIXTURES
B. ASTM D 1556 TEST FOR DENSITY OF SOIL IN PLACE BY THE SAND-CONE METHOD
C. ASTM D 1557 TEST FOR LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING MODIFIED EFFORT
D. ASTM D 2167 TEST FOR DENSITY AND UNIT WEIGHT OF SOIL IN PLACE BY THE RUBBER BALLOON METHOD

IX. END OF SECTION

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. Furnish, transport and place flowable controlled low-strength material (CLSM)
2. As backfill in
   a) trenches
   b) substitute for base or subbase course
   c) other uses
3. Backfill of utility trenches may require coordination with affected utility companies.
4. In accordance with the plans and with these specifications

II. MATERIALS

A. PORTLAND CEMENT

1. Conform to ASTM C 150:
   a) Type II or V
2. Not accepted:
   a) Partially set or contains lumps
   b) Cement from salvaged bags

B. FLY ASH

1. Conform to ASTM C 618
   a) Class F

C. FINE AGGREGATE (SAND)

1. Conform to ASTM C 33
   a) except for gradation which shall be per Table 1:

TABLE 1

SIEVE SIZE	PERCENT PASSING BY WEIGHT
¾ INCH	100
NO. 200	0-12

D. WATER

1. Free of oil, salt, acid, alkali, sugar, vegetable matter, other injurious substances

E. DYES

1. CLSM for utility trench backfill shall be dyed in accordance with the requirements of Section 5, Utilities.

III. MIX DESIGN

A. PROPORTIONS

1. Submit Mix Design showing
   a) Material proportions
   b) Material sources
   c) Admixtures
   d) Dry cubic yard batch weights
2. Mix shall contain, per cubic yard, at least:
   a) 50 pounds cement
   b) 250 pounds fly ash
   c) balance aggregate, water and approved admixtures

B. 28-DAY COMPRESSIVE STRENGTH:

1. 100-200 psi
2. specimens

a) made per ASTM C 31, except
(1) not rodded or vibrated
(2) air cured in molds for curing period
b) tested per ASTM C 39.
c) No significant strength gain after 28-days
(1) as demonstrated by test results

C. CONSISTENCY
1. Such that can be placed without segregation
2. Approximate desired consistency:
a) Fill open 3-inch diameter container with mixture
b) Pull container straight up
c) Should result in 8-inch circular spread without segregation

D. ADJUST PROPORTIONS
1. To achieve proper suspension/flow.
2. Maintain theoretical yield at one CY for given batch weights.

IV. CONSTRUCTION METHODS

A. PLACEMENT
1. Placement
a) Any reasonable means of placement allowed
b) Agitation required during transport and wait time
c) Do not displace pipes or structures
d) Avoid intrusion of CLSM into unwanted places
e) Bring up level uniformly
f) Each placement should be continuous operation if possible
(1) If not possible, ensure that lower levels are clear of surface water, debris.
2. Limitations on placement
a) Not placed on frozen ground.
b) Air and ground temperature shall be at least 35 deg F and rising
c) CLSM shall have temperature of at least 40 deg F
d) Mixing and placing to stop
(1) if air temperature is 40 deg F and falling, or
(2) if anticipated air or ground temperature will be 35 deg F or less in next 24 hours.

B. CURING AND PROTECTION
1. Curing
a) Maintain CLSM at temperatures above freezing for 72 hours.
b) CLSM subjected to freezing temperatures may be rejected by the Engineer if damage is observed.
2. Protection
a) For a period of 48 hours / or until compressive strength is 15 psi:
(1) Shall not be subject to loads
(2) Shall remain undisturbed by construction activities
(3) Contractor must provide evidence that requisite strength has been met.
(a) acceptable evidence = compressive strength tests from mix design

V. MATERIAL ACCEPTANCE

A. MATERIAL ACCEPTANCE
1. Based on mix design approval and batch tickets
2. Contractor shall verify mix by testing additional 5,000 CY of material from job delivery

a) Compressive tests to determine conformance with mix design
b) Adjustments may be required for subsequent deliveries.

VI. SUBMITTAL REQUIREMENTS

A. MIX DESIGN
1. Materials
2. Strength

VII. METHOD OF MEASUREMENT

A. CLSM FOR UTILITY TRENCHES
1. Not measured for payment
2. Considered incidental to utility installation

B. CLSM FOR BASE OR SUBBASE COURSE
1. per cubic yard

VIII. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
1. 24.1 CLSM for Base or Subbase Course – per cubic yard
2. Is full compensation for all materials, labor, equipment, tools and incidentals.
3. No separate payment for work in areas of night or limited-time construction area.
4. No separate payment if coordination with utility companies required.

IX. TESTING REQUIREMENTS

A. ASTM C 31 MAKING AND CURING CONCRETE TEST SPECIMENS IN THE FIELD

B. ASTM C 39 COMPRESSIVE STRENGTH OF CYLINDRICAL CONCRETE

X. MATERIAL REQUIREMENTS

A. ASTM C 33 SPECIFICATION FOR CONCRETE AGGREGATES

B. ASTM C 150 SPECIFICATION FOR PORTLAND CEMENT

C. ASTM C 618 SPECIFICATION FOR COAL FLY ASH AND RAW OR CALCINED NATURAL POZZOLAN FOR USE AS A MINERAL ADMIXTURE IN CONCRETE

D. ASTM C 595 SPECIFICATION FOR BLENDED HYDRAULIC CEMENTS

XI. END OF SECTION

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
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I. DESCRIPTION

A. GRANULAR SUBBASE
1. on prepared subgrade
2. To dimensions, lines and grades, on plans

B. MATERIAL MAY BE:
1. P-154 Aggregate Subbase
2. Processed Miscellaneous Base (PMB)

II. FAA ITEM P-154

A. MATERIALS
1. Hard, durable
2. May be mixed or blended with fines
3. Capable of being compacted into dense, stable subbase
4. Free of organics, lumps, excessive foreign material
5. Pit-run acceptable if spec is met.
6. Quality Requirements
   a) Gradation per Table 1:

TABLE 1 GRADATION REQUIREMENTS

SIEVE DESIGNATION (SQUARE OPENINGS) PER ASTM C 136 AND ASTM D 422	PERCENTAGE BY WEIGHT PASSING SIEVES
3 inch (75.0 mm)	100
No. 10 (2.0 mm)	20-100
No. 40 (0.450 mm)	5-60
No. 200 (0.075 mm)	0-8

   b) Other Requirements:
      (1) Atterberg limits:
         (a) For Portion passing No. 40:
            (i) LL not more than 25
            (ii) PI not more than 6
            (iii) as tested by ASTM D 4318
      (2) Max material finer than 0.02 mm: 3%
7. Testing Frequencies:
   a) Particle size distribution:
      (1) Preliminary
      (2) Once per day during construction

B. CONSTRUCTION METHODS
1. General
   a) Subbase to be shaped and compacted within specified tolerances
   b) If not sufficiently stable, Contractor shall add fine-grained material to bind.
      (1) Shall be sufficient so that subbase stable under construction traffic.
      (2) Addition shall not increase soil constants above the limits specified
2. Operation in Pits

a) Operations in pits at Contractor's expense.
b) Product from pits shall be uniform and in conformance with this section.

3. Preparing Underlying Course
   a) Engineer to approve condition of underlying course prior to placing subbase
4. To protect drainage begin placement at crown, or high side of pavement structure
5. Materials Acceptance in Existing Condition
   a) May be obtained from pits, stockpiles or crushing plant
   b) Intent is that no further mixing will be required on grade.
   c) Shall be placed on grade in:
      (1) uniform condition
      (2) containing approximately correct moisture
         (a) minor moisture deficiency/excess can be correctly be sprinkling/aeration.
      (3) conforming to gradation, quality and consistency requirements
      (4) not requiring further mixing
   d) Final operation to be blading/dragging to obtain
      (1) uniform surface
      (2) true to line and grade

6. Plant Mixing
   a) General
      (1) If necessary to mix materials, shall be done at:
         (a) central plant
         (b) traveling mixing plant
      (2) Mixed with proper amount of water
      (3) Transport to grade without undue loss of moisture
   b) [OPTIONAL: Mixed in Place
      (1) If mixing in place approved, ~~Engineer to designate relative components~~ Contractor to determine proportions necessary to meet spec.
      (2) Deposit material on grade, followed by binder or filler
      (3) As many layers ~~as the Engineer may direct~~ as the Contractor deems necessary to meet the requirements of this section.
      (4) Mix with necessary equipment until thoroughly mixed
         (a) Correct segregated areas
         (b) Add necessary moisture ~~as directed by the Engineer.~~
      (5) Shape and compact to meet:
         (a) density requirements
         (b) thickness
         (c) grade]
7. General Methods for Placing
   a) Construct in layers
      (1) 3" to 8 " in thickness
      (2) deposit and spread evenly
         (a) uniform thickness
         (b) uniform width
      (3) Spread no more than 2,000 square yards ahead of rolling.
         (a) Sprinkling to be kept within this limit
   b) If multiple layers required, requirements herein shall apply similarly to each layer.
   c) Caution shall be exercised to prevent incorporation of subgrade, shoulder, foreign material
8. Finishing and Compacting

a) After spreading, thoroughly compact by rolling and sprinkling, if necessary.
b) Provide sufficient rollers to compact material to specified density.
c) Compact to:
    (1) 100% maximum density in accordance with:
        (a) If more than 30% retained on ¾ sieve:
            (i) AASHTO T-99
            (ii) AASHTO T-180
        (b) ASTM D 1557 (>60,00# aircraft)
        (c) ASTM D 698 (< 60,000 # aircraft)
    (2) In place density per:
        (a) ASTM D 1556
        (b) ASTM D2922
    (3) At moisture content within +/- 2% optimum
        (a) If material is too free-draining to retain optimum moisture, may make field-determination of proper compaction moisture content.
    (4) Testing frequency:
        (a) Before and after compaction
        (b) Every 1,000 cubic yards
    (5) If nuclear density gauges allowed, refer to Section [ ] of these Specifications, Nuclear Gauges.
d) If soft, yielding, undulations > ½ inch in 16 feet:
    (1) loosen surface
    (2) refill and recompact
e) Areas inaccessible to rollers may be compacted with mechanical/hand tampers.
f) When sprinkling, do to allow manner/quantity of free water to reach underlying course.

9. Surface Test – After compaction test for:
    a) Smoothness
        (1) ½ inch in 16-ft
        (2) parallel and perpendicular to centerline
    b) Accuracy of grade and crown
    c) Scarify, reshape, recompact if not accepted
10. Thickness.
    a) Determine by:
        (1) depth tests or cores
            (a) Every 500 square yards or less
            (b) Deficiency more than ½ inch:
                (i) Correct by scarify, rework, recompact
            (c) Contractor to repair core holes at his own expense.
        (2) Survey
11. Protection
    a) Subbase work not allowed on:
        (1) wet subgrade
        (2) frozen subgrade
12. Maintenance
    a) Contractor shall maintain completed sections with standard motor graders rollers until:
        (1) accepted
        (2) next course ready to be placed

III. PROCESSED MISCELLANEOUS BASE (PMB)

A. GENERAL
1. In lieu of P-154 if approved by the Engineer
2. PMB material shall conform to Greenbook Section 200-2.5 – Processed Miscellaneous Base.
3. Construction methods shall be as per P-154, above.
4. When noted in the plans as acceptable, PMB may be:
   a) Contractor-provided
   b) Contractor-produced from job-site demolition products
      (1) may be produced on site from crushing [concrete][and][or][and/or][asphalt] pavement.
      (2) See Section 14 – Removals
      (3) Crushing paid under Section [ ] of these specifications, Removals.

B. [OPTIONAL: PMB FOR HAUL ROADS:
1. Contractor to stake alignment which eliminates conflicts with:
   a) lights
   b) signs
   c) drainage structures
   d) other airfield structures and utilities
2. Alignment to be approved by the Engineer prior to placement of PMB
3. Contractor to maintain haul roads throughout project.]

IV. SUBMITTAL REQUIREMENTS

A. MATERIAL QUALITY

V. METHOD OF MEASUREMENT

A. P-154 OR PMB
1. Per [Cubic Yard] or [Square Yard] placed of type specified – placed, compacted and accepted
2. Cubic yard quantity measured in final position based on either:
   a) depth tests/cores - 1 test per 500 sq yds
      (1) Thickness tests more than ½ inch in excess of plan thickness shall be computed and paid as plan thickness + ½ inch.
   b) Average end area method – computed to nearest 0.01 ft.
3. Subbase quantities not to be included in other excavation quantities.

VI. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER:
1. 25.1 Granular Subbase P-154 - per [cubic yard][square yard]
2. 25.2 Processed Miscellaneous Base (PMB) - per [cubic yard][square yard]
3. Includes all: material, preparation, hauling, placing, labor, equipment, tools, incidentals
4. Crushing on-site materials for PMB paid under Section [ ] of these specifications, Removals.
5. No separate payment for work in areas of night or limited-time construction area.

VII. TESTING REQUIREMENTS

A. ASTM C 136 SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
B. ASTM D 422 PARTICLE SIZE ANALYSIS OF SOILS

C. ASTM D 698 MOISTURE-DENSITY RELATIONS OF SOILS AND SOIL-AGGREGATE MIXTURES USING 5.5 LB (2.49 KG) RAMMER AND 12-IN (305 MM) DROP
D. ASTM D 1556 DENSITY OF SOIL IN PLACE BY THE SAND-CONE METHOD
E. ASTM D 1557 TEST FOR LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING MODIFIED EFFORT
F. ASTM D 2922 DENSITY OF SOIL IN PLACE BY THE NUCLEAR DENSITY METHOD
G. ASTM D 4318 LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS

VIII. END OF SECTION 25

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I. DESCRIPTION

A. NOTES TO ENGINEER:
1. Check soluble sulfate content of soil to ensure it is candidate for lime-treatment.
2. Contents as low as 0.5% have caused expansion problems.

B. ONE OR MORE COURSES:
1. Mixture of soil, lime, water
2. To lines, grades, thicknesses, and typical cross sections shown on the plans.

II. MATERIALS

A. HYDRATED LIME
1. Manufactured high-calcium quicklime
2. Low-calcium quicklime, or
3. Hydrated Lime
4. As defined by ASTM C 51
5. Conforming to ASTM C 977
6. Not permitted:
   (1) Calcium oxide(CaO),
   (2) Calcium hydroxide(Ca(OH)2)
   (3) Magnesium oxide (MgO)
   (4) Magnesium hydroxide (Mg(OH)2)
   (5) alone or in combination
   (6) not directly produced from quicklime produced from calcining limestone

B. COMMERCIAL LIME SLURRY
1. Pumpable suspension,
2. Liquid portion shall not contain dissolved injurious or objectionable material.
3. Solids portion shall be principally hydrated lime of sufficient quality and fineness to meet following requirements:
   a) Chemical composition: 70% by weight of calcium and magnesium oxides.
   b) Residue: conform to following:
      (1) Retained on a No. 6 sieve: Max. 0.0%
      (2) Residue retained on a No. 10 sieve: Max. 1.0%
      (3) Residue retained on a No. 30 sieve: Max. 2.5%
   c) Grade: Shall conform to one of the following:
      (1) Grade 1. Dry solids content shall be at least 31%, by weight, of the slurry.
      (2) Grade 2. Dry solids content shall be at least 35%, by weight, of the slurry.

C. WATER
1. Clean – free of oil, salt, acid, alkali, sugar, vegetable, or other injurious substances
2. Potable per AASHTO T 26.
3. Water known to be potable need not be tested.

D. SOIL
1. Uniform in Quality and Gradation.
2. Free of roots, sod, weeds, and stones larger than 2-1/2 inches.

III. COMPOSITION

A. LIME
1. Contractor to provide Mix Design to determine proper percentage of lime

a) % should be sufficient to lower LL to <30.
b) % should be sufficient to lower PI to 130.
c) % should be sufficient to increase CBR (compacted to 93% maximum density as determined by ASTM D 698) to [insert target CBR].

2. Percentage of lime shall not be more than 0.25% above that required to satisfy a) through c) above.

B. TOLERANCES
1. At final compaction:
a) Lime tolerance: + 0.5%
b) Water tolerance: + 2%, -0%

IV. WEATHER LIMITATIONS

A. SUSPEND WORK UNDER THE FOLLOWING CONDITIONS:
1. Temperature
a) below 40 deg F
b) may fall below 40 deg F w/I 24 hours
2. Other conditions
a) fog
b) rain
c) frozen subgrade

V. EQUIPMENT

A. REQUIRED EQUIPMENT:
1. Grading Equipment
2. Scarifying Equipment
3. Spreader For Lime or Lime Slurry
4. Mixing or Pulverizing Equipment
5. Sheepsfoot
6. Pneumatic or Vibrating Rollers
7. Sprinkling Equipment
8. Trucks

VI. CONSTRUCTION METHODS

A. GENERAL
1. Uniformity of treated subgrade
a) uniform lime mixture
b) free from loose or segregated areas
c) uniform density and moisture content
d) well bound for full depth
e) smooth surface
2. Contractor's responsibility to:
a) use proper amount lime
b) maintain the work
c) rework courses and necessary
3. Prior to lime treatment:
a) Subgrade brought to grade per Section [ ], Earthwork
(1) Except that no compaction required within thickness of planned lime-treatment
b) Excavate to secondary grade (bottom of lime-treatment)
(1) remove
(2) windrow
c) Correct wet or unsuitable conditions in secondary grade
(1) scarify

(2) add lime
(3) compact until of uniform stability

d) Spread excavated material.

e) May use cutting and pulverizing machine that will accurately cut/pulverize to secondary grade
(1) windrowing not required
(2) rolling is required to identify, correct soft areas before using pulverizing equipment.
(3) machine must give visible indication of proper depth of cutting/pulverizing

B. APPLICATION

1. General
a) Spread only as far as can be fully worked in same day.

2. Dry Placing
a) Dry method not allowed.

3. Slurry Placing
a) Mixed in water and applied as thin water suspension.
b) Commercial slurry with lime percentage not less than the applicable grade.
c) Make successive passes until amount of lime required in mix design is placed for the subject layer.
d) Distributor trucks shall continually agitate slurry.

C. MIXING

1. First Mixing
a) Mix full depth with approved mixing machine.
(1) Make two coverages with mixing machine.
(2) Add water to provide above optimum to ensure chemical reaction.
b) Do not leave exposed for more than 6 hours.
(1) These areas will not be accepted for payment.
c) Lightly roll to seal surface/minimize evaporation.
d) Maintain above optimum moisture by sprinkling for:
(1) 48 hours or
(2) until mixture becomes friable.

2. Final Mixing
a) After specified curing time, scarify/mix uniformly until clod size meets following:
(1) Minimum of clods passing 1-1/2 inch sieve 100 %
(2) Minimum of clods passing No. 4 sieve 60%

D. COMPACTION

1. Begin immediately after final mixing.
a) Do not leave any area undisturbed for more than 30 minutes.

2. Aerate/sprinkle to provide optimum moisture as ~~directed by the Engineer~~ required to meet the following:
a) tolerance +/- 2%
b) optimum determined by D 698.
c) less than amount which will cause instability during compaction/finishing.

3. Compact:
a) to 93% maximum density
(1) as determined by D 698.
(2) In-place density determined by D 1556 or D 2922.
b) or as necessary to remain firm and stable under construction traffic.
c) Rework if density tests fail.

4. Maintain surface in smooth condition until acceptance

a) Irregularities, depressions, weak spots shall be corrected immediately by scarifying, sprinkling, shaping, recompacting.

E. FINISHING AND CURING
1. After final layer compacted, bring to plan lines and grades and finish by rolling.
a) roller to be sufficiently light to prevent hairline cracking
2. Smoothness tolerance:
a) 3/8 inch in 16 ft.
b) tested parallel and perpendicular to centerline
c) Contractor to correct areas showing variations outside this limit at his own expense.
3. Curing
a) Moist cure
(1) Minimum 7 days before next course constructed or traffic allowed.
b) Apply subsequent course within 14 days.

F. THICKNESS
1. Determined by depth tests or cores
a) Every 300 square yards or less
b) If deficiency more than ½ inch Contractor shall correct at his expense.
c) Contractor to repair core holes at his expense.

G. MAINTENANCE
1. Contractor shall maintain condition of treated subgrade until completed, cured, accepted by the Engineer.

VII. SUBMITTAL REQUIREMENTS

A. SLURRY MIX DESIGN

VIII. METHOD OF MEASUREMENT

A. LIME-TREATED SUBGRADE
1. per square yard

B. LIME
1. per ton

IX. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
1. 26.1 Lime -Treated Subgrade – per square yard
2. 26.2 Lime – per ton
3. Is full compensation for all preparation, delivering, placing, mixing, labor, equipment, tools and incidentals
4. No separate payment for work in areas of night or limited-time construction area.

X. TESTING REQUIREMENTS

A. ASTM D 698 MOISTURE-DENSITY RELATIONS OF SOILS AND SOIL-AGGREGATE MIXTURES USING 5.5 LB (2.49 KG) RAMMER AND 12-IN. (305 MM) DROP

B. ASTM D 1556 DENSITY OF SOIL IN PLACE BY THE SAND-CONE METHOD

C. ASTM D 2922 DENSITY OF SOIL IN PLACE BY THE NUCLEAR DENSITY METHOD

D. AASHTO T 26 QUALITY OF WATER TO BE USED IN CONCRETE

XI. MATERIAL REQUIREMENTS

A. ASTM C 977 QUICKLIME AND HYDRATED LIME FOR SOIL STABILIZATION

XII. END OF SECTION

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
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I. DESCRIPTION

A. GENERAL
1. Temporary control measures as shown on plans or ordered by the Engineer.
2. Through the life of the contract
3. Control:
   a) Water pollution
   b) Soil erosion
   c) Siltation
4. In conformance with plans and specifications.
5. See also requirements in Section 7-8.6 of these specifications, Water Pollution Control.

B. METHODS
1. Berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains,
2. Other erosion control devices or methods.
3. May involve work outside the construction limits

C. COORDINATION
1. With permanent control measures
   a) to the extent practical
   b) to ensure economical, effective, continuous control

II. MATERIALS

A. GRASS
1. Shall not compete with permanent grasses to be sown later
2. Shall be quick growing species, or
3. Shall be the following:
   a) [name species]

B. MULCHES
1. Straw, fiber mats, netting, bark, wood chips
2. Other suitable materials
3. Reasonably clean and free of noxious weeds and deleterious materials.

C. FERTILIZER
1. Standard commercial grade
2. Conform to all Federal and State regulations
3. Conform to standards of the Association of Official Agricultural Chemists.

D. SLOPE DRAINS
1. Pipe, fiber mats, rubble, portland cement concrete, bituminous concrete, or
2. Other approved materials

E. OTHER
1. Shall meet commercial standards
2. Shall be approved by the Engineer in advance of incorporation into project

III. CONSTRUCTION METHODS

A. GENERAL
1. Conflicts between
   a) This specification
   b) Federal, state, or local agencies requirements
      (1) more restrictive shall apply.
2. Responsibility for assuring compliance
   a) ~~Engineer~~ Contractor
3. Compliance may include requirements relative to:

a) Use of smoke density charts.
b) Measurement of weight and density suspended particulate.
c) Permissible weights of emission in pounds per hour versus pounds per hour (of material processed.
d) Open burning.
e) Erosion control measures.

B. SCHEDULE
1. Contractor to submit prior to construction
2. Address temporary and permanent erosion control as applicable to
a) clearing and grubbing
b) grading
c) construction
d) paving
e) structures at watercourses.
3. Submit proposed methods of:
a) Erosion control
b) Dust control on haul roads, borrow pits – may include:
(1) Minimize area of exposed erodible earth.
(2) Apply temporary mulch with or without seeding.
(3) Use water sprinkler trucks.
(4) Use covered haul trucks.
(5) Use dust palliatives ~~or penetration asphalt~~ on haul roads.
(6) Use plastic sheet coverings.
c) Waste disposal
4. Must be approved by Engineer prior to start of work.

C. AUTHORITY OF THE ENGINEER
1. Has the authority to:
a) limit exposed area of erodible earth
b) direct Contractor to provide immediate control measures
(1) to minimize contamination of watercourses
(a) permanent or
(b) temporary

D. CONSTRUCTION DETAILS
1. Incorporate permanent erosion control measures
a) at earliest possible date
b) permanent seeding and mulching as soon as exposed slopes can be made available
(1) unless future work will damage slopes
2. Use permanent or temporary measures to prevent erosion from conditions
a) that develop during construction
b) that were unforeseen during design
c) that are needed prior to installation of permanent control measures
d) that are needed temporarily to control effects of normal construction activities
3. Where erosion likely to be a problem:
a) limit areas of clearing, grubbing, excavation, borrow, embankment
(1) commensurate with ability to finish
(a) grading, mulching, seeding
(b) other permanent control measures
b) if coordination with permanent measures unrealistic
(1) take temporary measures immediately
4. If erosion due to Contractor's negligence
a) corrections shall be at his expense
5. Contractor shall maintain measures throughout project

6. Where equipment frequently crosses watercourses
   a) provide temporary structures to prevent affecting sediment levels
7. Pollutants shall not be discharged into channels leading to natural watercourses, including:
   a) fuels
   b) lubricants
   c) bitumen
   d) raw sewage
   e) wash water
   f) other materials deleterious to water quality
   g) materials prohibited under other laws and regulations

IV. SUBMITTAL REQUIREMENTS

A. SCHEDULE
B. PROPOSED METHODS
C. MATERIALS

V. METHOD OF MEASUREMENT

A. TEMPORARY EROSION CONTROL
   1. per lump sum
   2. includes all work required to meet requirements including
      a) Temporary seeding, mulching, fertilizing
      b) Temporary slope drains
      c) Temporary benches, dikes, dams, and sediment basins including
         (1) cleaning of sediment basins
         (2) embankment placed at the direction of the Engineer, in excess of plan lines and elevations.
      d) Erosion control work required outside the work limits
      e) All other work required to prevent erosion or water pollution.

VI. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
   1. 27.1 Temporary Erosion Control – per lump sum
   2. Is full compensation for all materials, labor, equipment, tools and incidentals.
   3. No separate payment for work in areas of night or limited-time construction area.

VII. END OF SECTION

SECTION 28 – AGGREGATE BASE COURSE (FAA P-208)

28-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of aggregate base course for, use under runway shoulder, taxiway shoulder and roadway pavement, in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-208, as included and modified hereafter, and as shown on the Plans.

[For base course under runway and taxiway surfaces, use Section 29, FAA Item P-209.]

[When approved by the Engineer, Processed Miscellaneous Base, conforming to Section 25 of these specifications may be used in lieu of P-208 for base courses under runway shoulder, taxiway shoulder and roadway pavement.]

ITEM P-208 AGGREGATE BASE COURSE

208-1.1 *This item shall consist of a base course composed of crushed or uncrushed coarse aggregate, as specified in the bid schedule, bonded with either soil or fine aggregate or both. It shall be constructed on a prepared underlying course in accordance with these specifications and shall conform to the dimensions and typical cross section shown on the plans.*

MATERIALS

208-2.1 UNCRUSHED COARSE AGGREGATE*. The base course material shall consist of hard, durable particles or fragments of stone or gravel mixed or blended with sand, stone dust, or other similar binding or filler materials produced from approved sources. All oversized stones, rocks and boulders occurring in the pit or quarry material shall be wasted; those of acceptable quality may be crushed and become a part of the base material, provided the blend meets the specified gradations. The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances. The coarse aggregate shall have a percent of wear not more than 45 at 500 revolutions as determined by ASTM C 131.*

208-2.2 CRUSHED COARSE AGGREGATE*. The aggregates shall consist of both fine and coarse fragments of crushed stone, crushed slag, or crushed gravel mixed or blended with sand, screenings, or other similar approved materials. The crushed stone shall consist of hard, durable particles or fragments of stone and shall be free from excess flat, elongated, soft or disintegrated pieces, dirt, or other objectionable matter.*

The crushed slag shall be air-cooled, blast furnace slag and shall consist of angular fragments reasonably uniform in density and quality and shall be reasonably free from thin, elongated, or soft pieces, dirt, and other objectionable matter. It shall weigh not less than 70 pounds per cubic foot as determined by ASTM C 29.

The crushed gravel shall consist of hard, durable stones, rock, and boulders crushed to specified size and shall be free from excess flat, elongated, soft or disintegrated pieces, dirt, or other objectionable matter. The method used in production of crushed gravel shall be such that the fractured particles occurring in the finished product shall be as nearly constant and uniform as practicable and shall result in a minimum of 60% of the material retained on the No. 4 sieve having at least 2 fractured faces and 75% having at least 1 fractured face.

If necessary to meet this requirement or to eliminate an excess of fine, uncrushed particles, the gravel shall be screened before crushing. All stones, rocks, and boulders of inferior quality in the pit shall be wasted.

The crushed coarse aggregate shall have a percent of wear not more than 50 at 500 revolutions as determined by ASTM C 131.

All material passing the No. 4 mesh sieve produced in the crushing operation of either stone, slag, or gravel shall be incorporated in the base material to the extent permitted by the gradation requirements.

***208-2.3 GRADATION**. The gradation of the uncrushed or crushed material shall meet the requirements of one of the gradations given in Table 1 when tested in accordance with ASTM C 117, ASTM C 136, and ASTM D 422.*

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE			
Sieve Designation	***Percentage by weight passing sieves***		
	2" maximum	***1-1/2" maximum***	***1' 'maximum***
2 inch	*100*	*--*	*--*
1-1/2 inch	*70-100*	*100*	*--*
1 inch	*55-85*	*70-100*	*100*
3/4 inch	*50-80*	*55-85*	*70-100*
No. 4	*30-60*	*30-60*	*35-65*
No. 40	*10-30*	*10-30*	*10-25*
No. 200 (	*5-15*	*5-15*	*5-15*

The gradations in the table represent the limits that shall determine suitability of aggregate for use from the sources of supply. The final gradations decided on within the limits designated in the table shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves, or vice versa.

The amount of the fraction of material passing the No. 200 mesh sieve shall not exceed one-half the fraction passing the No. 40 mesh sieve. The aggregate blend shall not contain more than 3% material finer than 0.02 mm unless all materials are produced from crushed stone.

The portion of the filler and binder, including any blended material, passing the No. 40 mesh sieve have a liquid limit not more than 25 and a plasticity index not more than 6 when tested in accordance with ASTM D 4318.

The selection of any of the gradations shown in the table shall be such that the maximum size aggregate used in any course shall be not more than two-thirds the thickness of the layer of the course being constructed.

***208-2.4 FILLER FOR BLENDING**. If filler, in addition to that naturally present in the base course material, is necessary for satisfactory bonding of the material, for changing the soil constants of the material passing the No. 40 mesh sieve, or for correcting the gradation to the limitations of the specified gradation, it shall be uniformly blended with the base course material at the crushing plant or at the mixing plant. The material for such purpose shall be obtained from*

sources approved by the Engineer and shall be of a gradation necessary to accomplish the specified gradation in the finally processed material.

The additional filler may be composed of sand, but the amount of sand shall not exceed 20% by weight of the total combined base aggregate. All the sand shall pass a No. 4 mesh sieve and not more than 5% by weight shall pass a No. 200 mesh sieve.

CONSTRUCTION METHODS

***208-3.1 OPERATIONS IN PITS AND QUARRIES**. All work involved in clearing and stripping pits and quarries, including handling of unsuitable material, shall be performed by the Contractor. All material shall be handled in a manner that shall secure a uniform and satisfactory base product. The base course material shall be obtained from sources that have been approved.*

***208-3.2 PREPARING UNDERLYING COURSE**. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft, yielding places due to improper drainage conditions, hauling, or any other cause, shall be corrected and rolled to the required density before the base course is placed thereon.*

To protect the underlying course and to ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

208-3.3 METHODS OF PRODUCTION

***a. Plant Mix**. When provided in the proposal, or when selected by the Contractor and approved by the Engineer, the base material shall be uniformly blended or mixed in an approved plant. The mixing plant shall include bins for storage and batching of the aggregate, pump and tanks for water, and batch mixers of either the pugmill or drum type. All mineral aggregates shall be batched into the mixer by weight. The agitation shall be such that a thorough dispersion of moisture is obtained. The size of the batch and the time of mixing shall be fixed by the Engineer and shall produce the results and requirements specified. The base course material produced by combining two or more materials from different sources shall be mixed in a mixing plant described herein. The mixture material shall be at a satisfactory moisture content to obtain maximum density.*

***b. Travel Plant**. When the use of a traveling plant is allowed, the plant shall blend and mix the materials to meet these specifications. It shall accomplish a thorough mixing in one trip. The agitation shall be such that the*

dispersion of the moisture is complete. The machine shall move at a uniform rate of speed and this speed shall be regulated to fix the mixing time. If a windrow-type of travel plant is employed for mixing, the aggregate shall be placed in windrows parallel to the pavement centerline.

The windrow volume shall be sufficient to cover exact areas as planned. The windrow contents shall produce a mixture of the required gradation and bonding qualities. If a travel plant is used which is of the type that mixes previously spread aggregates in-place, the material shall have been spread in such thickness and proportions as may be handled by the machine to develop a base course of the thickness of each layer and of the gradation required. With either type of equipment, the mixed material shall be at a satisfactory moisture content to obtain the maximum density.

***c. Materials of Proper Gradation**. When the entire base course material from coarse to fine is secured in a uniform and well-graded condition and contains approximately the proper moisture, such approved material may be handled directly to the spreading equipment. The material may be obtained from gravel pits, stockpiles, or produced from a crushing and screening plant with the proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The intent of this section of these specifications is to secure materials that will not require further mixing. The base material shall be at a satisfactory moisture content to obtain maximum density. Any minor deficiency or excess of moisture may be corrected by surface sprinkling or by aeration. In such instances some mixing or manipulation may be required immediately preceding the rolling to obtain the required moisture content. The final operation shall be blading, if necessary, to obtain a smooth uniform surface true to line and grade.*

***208-3.4 PLACING**.*

***a.** The aggregate base material that is correctly proportioned, or has been processed in a plant, shall be placed on the prepared underlying course and compacted in layers of the thickness shown on the plans. The depositing and spreading of the material shall commence where designated and shall progress continuously without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. The base aggregate shall be spread by spreader boxes or other approved devices having positive thickness controls that shall spread the aggregate in the required amount to avoid or minimize the need for hand manipulation. Dumping from vehicles in piles that require rehandling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.*

b. *The aggregate base material that has been processed in a traveling plant, or mixed and blended in-place, shall be spread in a uniform layer of required depth and width and to the typical cross section. The spreading shall be by a self-powered blade grader, mechanical spreader, or other approved method. In spreading, care shall be taken to prevent cutting into the underlying layer. The material shall be bladed until a smooth, uniform surface is obtained, true to line and grade.*

c. *The base course shall be constructed in a layer not less than 3 inches nor more than 6 inches of compacted thickness. The aggregate as spread shall be of uniform grading with no pockets of fine or coarse materials. The aggregate, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling shall be kept within these limits. No material shall be placed in snow or on a soft, muddy, or frozen course.*

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

During the mixing and spreading process, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the base course mixture.

208-3.5 COMPACTION*. Immediately upon completion of the spreading operations, the aggregate shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.*

The moisture content of the material during placing operations shall not be below, nor more than 2 percentage points above, the optimum moisture content as determined by ASTM 3017.

208-3.6 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY*. Aggregate base course shall be accepted for density on a lot basis. A lot will consist of one day's production where it is not expected to exceed 2400 square yards. A lot will consist of one-half day's production where a day's production is expected to consist of between 2400 and 4800 square yards.*

Each lot shall be divided into two equal sublots. One test shall be made for each sublot. Sampling locations will be determined by the Engineer on a random basis in accordance with statistical procedures contained in ASTM D 3665.

Each lot will be accepted for density when the field density is at least 100 percent of the maximum density of laboratory specimens prepared from samples of the material delivered to the jobsite. The specimens shall be compacted and tested in

accordance with ASTM D 1557. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167. If the specified density is not attained, the entire lot shall be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached.

***208-3.7 SURFACE TEST**. After the course has been completely compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified, reshaped, recompacted, and otherwise manipulated as the Engineer may direct until the required smoothness and accuracy are obtained. The finished surface shall not vary more than 3/8 inch from a 16-foot straightedge when applied to the surface parallel with, and at right angles to, the centerline.*

***208-3.8 THICKNESS**. The thickness of the base course shall be determined by depth tests or cores taken at intervals in such manner that each test shall represent no more than 300 square yards. When the base deficiency is more than 1/2 inch, the Contractor shall correct such areas by scarifying, adding satisfactory base mixture, rolling, sprinkling, reshaping, and finishing in accordance with these specifications. The Contractor shall replace, at his/her expense, the base material where borings have been taken for test purposes.*

***208-3.9 PROTECTION**. Work on the base course shall not be accomplished during freezing temperatures nor when the subgrade is wet. When the aggregates contain frozen materials or when the underlying course is frozen, the construction shall be stopped.*

Hauling equipment may be routed over completed portions of the base course, provided no damage results and provided that such equipment is routed over the full width of the base course to avoid rutting or uneven compaction. However, the Engineer in charge shall have full and specific authority to stop all hauling over completed or partially completed base course when, in his/her opinion, such hauling is causing damage. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at his/her own expense.

***208-3.10 MAINTENANCE**. Following the completion of the base course, the Contractor shall perform all maintenance work necessary to keep the base course in a condition satisfactory for priming. After priming, the surface shall be kept clean and free from foreign material. The base course shall be properly drained at all times. If cleaning is necessary, or if the prime coat becomes disturbed, any work or restitution necessary shall be performed at the expense of the Contractor.*

Before preparations begin for the application of a surface treatment or for a surface course, the base course shall be allowed to partially dry until the average

moisture content of the full depth of base is less than 80% of the optimum moisture of the base mixture. The drying shall not continue to the extent that the surface of the base becomes dusty with consequent loss of binder. If during the curing period the surface of the base dries too fast, it shall be kept moist by sprinkling until such time as the prime coat is applied as directed.

The Contractor shall remove all survey and grade hubs from the base courses prior to placing any bituminous surface course.

METHOD OF MEASUREMENT

208-4.1 *See Section 28-2.*

BASIS OF PAYMENT

208-5.1 *See Section 28-3.*

TESTING REQUIREMENTS

ASTM C 29	*Unit Weight of Aggregate*
ASTM C 117	*Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing*
ASTM C 131	*Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine*
ASTM C 136	*Sieve Analysis of Fine and Coarse Aggregates*
ASTM D 422	*Particle Size Analysis of Soils*
ASTM D 698	*Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-in (305 mm) Drop*

ASTM D 1556 Density of Soil in Place by the Sand-Cone Method

ASTM D 1557 Test for Laboratory Compaction Characteristics of Soil Using Modified Effort

ASTM D 2167 Density of Soil in Place by the Rubber-Ballon Method

ASTM D 3665 Random Sampling of Paving Materials

ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF ITEM P-208

28-2 METHOD OF MEASUREMENT

The quantity of uncrushed or crushed aggregate base course to be paid for shall be the number of cubic yards of base course material placed, bonded, and accepted in the completed base course. The quantity of base course material shall be measured in final position based upon depth test, or cores taken as directed by the Engineer, or at the rate of 1 depth test for each 300 square yards of base course, or by means of average end areas on the complete work computed from elevations to the nearest 0.01 foot. On individual depth measurements, thicknesses more than 1/2 inch in excess of that shown on the plans shall be considered as specified thickness plus 1/2 inch in computing the yardage for payment. Base materials shall not be included in any other excavation quantities.

28-3 BASIS OF PAYMENT

Payment shall be made at the contract unit price per cubic yard for aggregate base course of the type noted in the bid schedule. This price shall be full compensation for furnishing all materials and for all operations, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

Item 28.1 **[Crushed][Uncrushed]** Aggregate Base Course – P-208.....per cubic yard

END OF SECTION 28

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SECTION 30 – RECYCLED CONCRETE AGGREGATE BASE COURSE (FAA P-219)

30-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of recycled concrete base course for asphalt or concrete pavement in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-219, as included and modified hereafter, and as shown on the Plans.

[Add Description of Special Requirements, Conditions]

ITEM P-219 RECYCLED CONCRETE AGGREGATE BASE COURSE

DESCRIPTION

219 -1.1 *This item consists of a base course composed of recycled concrete aggregate, crushed to meet a particular gradation, constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross sections shown on the plans.*

MATERIALS

219-2.1 AGGREGATE. *Recycled concrete aggregate shall consist of Portland cement concrete or other concrete containing pozzolanic binder material. The recycled concrete material shall be free of reinforcing steel, expansion material. Asphalt concrete overlays shall be removed from the PCC surface prior to pavement removal and crushing. Also, full-slab asphalt concrete panels (used as a replacement for a removed PCC slab) shall be removed. An incidental amount of recycled asphalt concrete pavement and other foreign material may be present in the recycled concrete aggregate.*

Recycled concrete aggregate for base course shall consist of at least 90 percent, by weight, Portland cement concrete, with the following materials making up the remaining 10 percent:

Wood - 0.1 percent maximum
Brick, mica, schist, or other friable materials - 4 percent maximum
Asphalt concrete – 10 percent maximum

Virgin aggregates may be added to meet the 90 percent minimum concrete requirement

The percentage of wood, brick, mica, schist, other friable materials, and asphalt concrete shall be determined by weighing that material retained on the No. 4 sieve, and dividing by the total weight of recycled concrete aggregate material retained on the No. 4 sieve.

Fine aggregate passing the No.4 sieve shall consist of fines from the operation of crushing the recycled concrete aggregate. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone, gravel, slag, or recycled concrete that meet the requirements for wear and soundness specified for coarse aggregate.

Recycled concrete aggregate shall not be used in locations with high sulfate content soils (no more than 1 percent).

The amount of flat and elongated particles in recycled concrete aggregate shall not exceed 20 percent for the fraction retained on the 0.5 inch sieve nor 20 percent for the fraction passing the 0.5 inch sieve when tested in accordance with ASTM D 4791. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

The percentage of wear shall not be greater than 45 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness test (ASTM C 88) requirement is waived for recycled concrete aggregate.

The fraction passing the No. 40 sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than 4 when tested in accordance with ASTM D 4318. The fine aggregate shall have a minimum sand equivalent value of 35 when tested in accordance with ASTM D 2419.

a. Sampling and Testing. *Recycled concrete aggregate samples for preliminary testing shall be furnished by the Contractor prior to the start of base construction. All tests for initial aggregate submittals necessary to determine compliance with the specification requirements will be made by the Engineer at no expense to the Contractor.*

Samples of recycled concrete aggregate shall be furnished by the Contractor at the start of production and at intervals during production. The sampling points and intervals will be designated by the Engineer. The samples will be the basis of approval of specific lots of recycled concrete aggregate for the quality requirements.

Samples of recycled concrete aggregate to check gradation shall be taken at least once daily. Sampling shall be in accordance with ASTM D 75, and testing shall be in accordance with ASTM C 136 and C 117.

b. Gradation Requirements. *The gradation (job mix) of the final mixture shall fall within the design range indicated in Table 1, when tested in accordance with ASTM C 117 and C 136. The final gradation shall be continuously graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.*

Table 1. Requirements for Gradation of Recycled Concrete Aggregate.		
Sieve Size	*Percentage by Weight Passing Sieves*	*Job Mix Tolerances Percent*
2 in	*100*	--
1-1/2	*95 - 100*	*+/- 5*
1 in	*70 - 95*	*+/- 8*
3/4 in	*55 - 85*	*+/- 8*
No.4	*30 - 60*	*+/- 8*
No. 30	*12 - 30*	*+/- 5*
No. 200	*0 - 5*	*+/- 3*

The job mix tolerances in Table 1 shall be applied to the job mix gradation to establish a job control gradation band. The full tolerance still will apply if application of the tolerances results in a job control gradation band outside the design range.

EQUIPMENT

219-3.1 GENERAL. *All equipment necessary to mix, transport, place, compact, and finish the recycled concrete aggregate base course shall be furnished by the Contractor. The Contractor shall provide written certification to the Engineer that all equipment meets the requirements for this section. The equipment shall be inspected by the Engineer at the job site prior to the start of I construction operations.*

219-3.2 MIXING EQUIPMENT. *Base course shall be thoroughly mixed in a plant suitable for recycled concrete aggregate. The mixer shall be a batch or continuous-flow type and shall be equipped with calibrated metering and feeding device that introduce the aggregate and water into the mixer in specified quantities. If necessary, a screening device shall be installed to remove oversized material greater than 2 in from the recycled concrete aggregate feed.*

Free access to the plant shall be provided to the Engineer at all times for inspection of the plant's equipment and operation and for sampling the mixed recycled concrete aggregate materials.

219-3.3 HAULING EQUIPMENT. *The mixed recycled concrete aggregate base course shall be transported from the plant to the job site in hauling equipment having beds that are smooth, clean, and tight. Truck bed covers shall be provided and used to protect the mixed recycled concrete aggregate base course from rain during transport.*

219-3.4 PLACING EQUIPMENT. *Recycled concrete aggregate shall be placed using a mechanical spreader or machine capable of receiving, spreading, and shaping the material without segregation into uniform layer or lift. The placing equipment shall be equipped with a strike off plate that can be adjusted to the layer thickness. The placing equipment shall have two end gates or cut off plates, so that the recycled concrete aggregate may be spread up to a lane width.*

219-3.5 COMPACTION EQUIPMENT. *Recycled concrete aggregate base course compaction shall be accomplished using one or a combination of the following pieces of equipment:*

Steel-wheeled roller,
Vibratory roller,
Pneumatic-tire roller,
Hand-operated power tampers (for areas inaccessible to rollers)

219-3.6 FINISHING EQUIPMENT. *Trimming of the compacted recycled concrete aggregate to meet surface requirements shall be accomplished using a self-propelled grader or trimming machine, with a mold board cutting edge of 12 ft minimum width automatically controlled by sensors in conjunction with an independent grade control from a taut string line. String line will be required on both sides of the sensor controls for all lanes.*

CONSTRUCTION METHODS

219-4.1 WEATHER LIMITATIONS. *Construction is allowed only when the atmospheric temperature is at or above 35 °F (2 °C). When the temperature falls below 35°F (2 °C), the contractor shall protect all completed areas against detrimental effects of freezing. Areas damaged by freezing, rainfall, or other weather conditions shall be corrected.*

219-4.2 PREPARING UNDERLYING COURSE. *The underlying course shall be checked by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen material.*

To protect the existing layers and to ensure proper drainage, the spreading of the recycled concrete aggregate base course shall begin along the centerline of the pavement on a crowned section or on the greatest contour elevation of a pavement with a variable uniform cross slope.

219-4.3 GRADE CONTROL. *Grade control between the edges of the recycled concrete aggregate base course shall be accomplished by grade stakes, steel pins, or forms placed in lanes parallel to the centerline and at intervals of 50 ft or less on the longitudinal grade and 25 ft or less on the transverse grade.*

219-4.4 MIXING. *The recycled concrete shall be uniformly blended during crushing operations and mixed with water in a mixing plant suitable for recycled concrete aggregate. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.*

219-4.5 PLACING. *The recycled concrete aggregate base material shall be placed on the moistened subgrade or base in layers of uniform thickness with an approved mechanical spreader.*

The maximum depth of a compacted layer shall be 6 inches. If the total depth of the compacted material is more than 6 inches, it shall be constructed in two or more layers. In multi-layer construction, the material shall be placed in approximately equal-depth layers.

The previously constructed layer shall be cleaned of loose and foreign material prior to placing the next layer. The surface of the compacted material shall be kept moist until covered with the next layer.

Adjustments in placing procedures or equipment shall be made to obtain grades, to minimize segregation grading, to adjust the water content, and to ensure an acceptable recycled concrete aggregate base course.

219-4.6. EDGES OF BASE COURSE. *The recycled concrete aggregate shall be placed so that the completed section will wider, on all sides, than the next layer that will be placed above it, as shown on the plans. Approved fill material shall be placed along the free edges of the recycled concrete aggregate in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a .multiple course, allowing in each operation at least a 2-ft width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of base course. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along the edge at the same time.*

219-4.7 COMPACTION. *Immediately upon completion of the spreading operations, the recycled concrete aggregate shall be compacted. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.*

Each layer of the recycled concrete aggregate base course shall be compacted to the required density using the compaction equipment. The moisture content of the material during placing operations shall not be below, nor more than 1-1/2 percentage points above, the optimum moisture content as determined by ASTM D 1557.

The compaction shall continue until each layer has a degree of compaction that is at least 100 percent of the laboratory maximum density through the full depth of the layer. The contractor shall make adjustments in compacting or finishing techniques to obtain true grades, to minimize segregation and degradation, to reduce or increase water content and to ensure a satisfactory base course. Any materials found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, so that the requirements of this specification are met.

219-4.8 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY. *Recycled concrete aggregate shall be accepted for gradation and density on a lot basis. A lot will consist of one day's production where it is not expected to exceed 2,400 square yards per lift. A lot will consist of one-half day's production, where a day's production is expected to consist of between 2,400 and 4,800 square yards per lift.*

Each lot shall be divided into two equal sublots. One gradation and density test shall be made for each sublot. Sampling locations will be determined on a random basis in accordance with statistical procedures contained in ASTM D 3665.

Each lot will be accepted for gradation when it falls within the limits and tolerances shown in Table 1 when tested in accordance with ASTM C117 and C 131. If the proper gradation is not attained the gradation test will be repeated. The entire lot shall be rejected and replaced by the Contractor at the Contractor's expense.

Each lot will be accepted for density when the field density is at least 100 percent of the maximum density of laboratory specimens prepared from samples of the base course material delivered to the job site. The specimens shall be compacted and tested in accordance with ASTM D 1557. The in-place field density shall be determined in accordance with ASTM D 1556 or D 2167. If the specified density is not attained, the entire lot shall be reworked and two additional random tests made. This procedure shall be followed until the specified density is reached.

In lieu of ASTM D 1556 or D 2167 method of field density determination, acceptance testing may be accomplished using a nuclear gage in accordance with ASTM D 2922. The gage should be field calibrated in accordance with paragraph 4 of ASTM D 2922. Calibration tests shall be conducted on the first lot of material placed that meets the density requirements.

Use of ASTM D 2922 results in a wet unit weight, and when using this method, ASTM D 3017 shall be used to determine the moisture content of the material. The calibration curve furnished with the moisture gages shall be checked as described in paragraph 7 of ASTM D 3017. The calibration checks of both the density and moisture gages shall be made at the beginning of a job and at regular intervals.

If a nuclear gage is used for density determination, two random measurements shall be made for each sublot.

219-4.9 FINISHING. *The surface of the recycled concrete aggregate base course shall be finished by equipment designed for this purpose.*

In no case will thin layers of material be added to the top of base course to meet grade. If the elevation of the layer is 1/2 inch or more below grade, the layer shall be scarified to a depth of at least 3 inches, new material added, and the layer shall be recompacted. If the finished surface is above plan grade, it shall be cut back to grade and rerolled.

Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, and recompacted or replaced at Contractor's expense.

219-4.10 SURFACE TOLERANCES. *The finished surface shall not vary more than 3/8 inch when tested with a 16-ft straightedge applied parallel with or at right angles to the centerline. The Contractor shall correct any deviation in excess of this amount, at the Contractor's expense.*

219-4.11 THICKNESS CONTROL. *The completed thickness of the base course shall be within 0.5 inch of the design thickness. Four determinations of thickness shall be made for each lot of material placed. Each lot shall be divided into four equal sublots. One test shall be made for each sublot. Sampling locations will be determined on a random basis in accordance with procedures contained in ASTM D 3665. Where the thickness is deficient by more than 0.5 inch, the Contractor shall correct such areas at no additional cost by excavating to the required depth and replacing with new material. Additional test holes may be required to identify the limits of deficient areas.*

219-4.12 TRAFFIC. *Equipment used in construction may be routed over completed portions of the base course, provided no damage results and provided that the equipment is distributed evenly over the full width of the base course to avoid rutting or uneven compaction.*

219-4.13 MAINTENANCE. *The base course shall be maintained until the base course is completed and accepted. Maintenance will include immediate repairs to any defects and shall be repeated as often as necessary to keep the completed work intact. Any area of the recycled concrete aggregate base course that is damaged shall be reworked as necessary.*

METHOD OF MEASUREMENT

219-5.1 *See Section 30-2.*

BASIS OF PAYMENT

219-6.1 *See Section 30-3.*

TESTING REQUIREMENTS

ASTM C 29	*Unit Weight of Aggregate*
ASTM C 117	*Materials Finer than 75J.lm (No. 200) Sieve in Mineral Aggregates by Washing*
ASTM C 131	*Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine*
ASTM C 136	*Sieve or Screen Analysis of Fine and Coarse Aggregate ASTM D 75 Sampling Aggregate*
ASTM D 693	*Crushed Stone, Crushed Slag, and Crushed Gravel for Dry-or Water- Bound Macadam Base Courses and Bituminous Macadam Base and Surface Courses of Pavements*
ASTM D 698	*Moisture-Density Relations of Soils and Soil - Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305-mm) Drop*
ASTM D 1556	*Density of Soil in Place by the Sand -Cone Method*

ASTM D 1557	*Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in (457-mm) Drop*
ASTM D 2167	*Density of Soil in Place by the Rubber-Balloon Method ASTM D 2419 Sand Equivalent Value of Soils and Fine Aggregate*
ASTM D 2922	*Density of Soil and Soil-Aggregate in Place by Nuclear Methods*
ASTM D 3017	*Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods*
ASTM D 3665	*Random Sampling of Paving Materials*
ASTM D 4318	*Liquid Limit, Plastic Limit, and Plasticity Index of Soils*

END OF P-219

30-2 METHOD OF MEASUREMENT

The quantity of recycled concrete aggregate base course to be paid will be determined by measurement of the number of cubic yards of material actually constructed and accepted as complying with the plans and specifications.

30-3 BASIS OF PAYMENT

Payment shall be made at the contract unit price per cubic yard for recycled concrete aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item. Payment will be made under:

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

Item 30.1 Recycled Concrete Aggregate Base Course .....per cubic yard

END OF SECTION 30

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SECTION 33 – ECONOCRETE BASE COURSE (FAA P-306)

33-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of a subbase material, herein termed econocrete, that is composed of aggregate and cement uniformly blended together and mixed with water. The mixture may also include approved cementitious additives, in the form of fly ash or slag, and chemical admixtures. The mixed material shall be spread, shaped, and consolidated using concrete paving equipment in accordance with these specifications and in conformity to the lines, grades, dimensions, and typical cross-sections shown on the plans.

The proper performance of Econocrete Base Course requires that the compressive strength of the Econocrete be limited between a low and a high compressive strength value. There will therefore be penalties for producing material that is either too weak or too strong. If strength exceeds the values indicated in this specification, the Contractor will be required to sawcut stress relief grooves to ensure proper performance of the Portland Cement Concrete pavement to be placed over the Econocrete. These sawcuts must match the location of the planned joints for the PCC pavement. If the specified Econocrete strength is exceeded, and the Contractor does not cut the stress relief grooves, he will be required to remove and replace the econocrete at his own expense. Payment will be not made for sawcutting, but it will be considered the sole responsibility of the Contractor for failing to adhere to the upper strength requirements of this Specification. If strength does not meet the minimum value indicated, the Econocrete will be removed and replaced at the Contractor's expense.

The Contractor will be allowed to use recycled aggregate for production of econocrete if the requirements of this section are met, including amelioration for excessive strength econocrete (saw cutting) is done.

ITEM P-306 ECONOCRETE BASE COURSE

DESCRIPTION

306-1.1 *This item shall consist of a subbase material, herein termed econocrete, that is composed of aggregate and cement uniformly blended together and mixed with water. The mixture may also include approved cementitious additives, in the form of fly ash or slag, and chemical admixtures. The mixed material shall be spread, shaped, and consolidated using concrete paving equipment in accordance with these specifications and in conformity to the lines, grades, dimensions, and typical cross-sections shown on the plans.*

MATERIALS

306-2.1 AGGREGATE. *The coarse aggregate fraction shall be crushed stone, crushed or uncrushed gravel, crushed and adequately seasoned, air-cooled, iron*

blast furnace slag, crushed recycled concrete, or a combination thereof. The fine aggregate fraction may be part of the natural aggregate blend as obtained from the borrow source or it may be natural sand that is added at the time of mixing.

The aggregate shall consist of hard, durable particles, free from an excess of flat, elongated, soft, or disintegrated pieces, or objectionable matter (e.g., roots, sod, weeds, organic impurities, etc.). A flat particle is one having a ratio of width to thickness greater than five; an elongated particle is one having a ratio of length to width greater than five.

Table 1. Aggregate – Econocrete Base Course	
Sieve Size (square openings)	*Percentage by Weight Passing Sieves*
2 inches	*100*
1 inch	*55 - 85*
3/4 inch	*50 - 80*
No. 4	*30 - 60*
No. 40	*10 - 30*
No. 200	*0 - 15*

Recycled aggregate may be used for econocrete aggregate if it meets the grading requirements of this section. Cement liberated from the crushing of concrete pavement for such recycling will have an unknown strength gain effect on the econocrete, however, and it is extremely likely that the Contractor will be required to do stress relief saw-cutting of the econocrete produced with this material. No separate payment will be made for such saw cutting which will be considered an incidental cost and shall be included in the price bid for econocrete.

***306-2.2 CEMENT**. Cement shall conform to the requirements of ASTM C 150, Type II.*

***306-2.3 CEMENTITIOUS ADDITIVES**. Pozzolanic and ground granulated blast furnace (GGBF) slag may be added to the econocrete mix. If used, each material must meet the following requirements:*

a. Pozzolan. Pozzolanic materials must meet the requirements of ASTM C 618, Class F Flyash.

b. Ground Granulated Blast Furnace Slag (Slag Cement). Slag shall conform to ASTM C 989, Grade 80, 100 or 120.

306-2.4 CHEMICAL ADMIXTURES. *The Contractor shall submit certificates indicating that the material to be furnished meets all the requirements listed below. In addition, the Engineer may require the Contractor to submit complete test data showing that the material to be furnished meets all the requirements of the cited specification.*

a. *Air-Entraining Admixtures. Air-entraining admixtures shall meet the requirements of ASTM C 260.*

b. *Water-Reducing Admixtures. Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions. The air entrainment agent and the water-reducing admixture shall be compatible.*

306-2.5 WATER. *Water used in mixing or curing shall be clean and free of oil, salt, acid, alkali, sugar, vegetable, or other deleterious substances injurious to the finished product. Water will be tested in accordance with the requirements of AASHTO T 26. Water known to be of potable quality may be used without testing.*

306-2.6 CURING MATERIALS. *For curing econocrete, use white-pigmented, liquid membrane-forming compound conforming to ASTM C 309, Type 2, Class A or Class B (wax-based) or Asphalt emulsion conforming to the requirements of ASTM D 977, Type SS-1h.*

COMPOSITION OF MIXTURE

306-3.1 MIX DESIGN. *The econocrete mix design shall be based on trial batch results conducted in the laboratory. The econocrete shall be designed to meet the criteria in this section.*

306-3.1.1 Compressive Strength. *Compressive strength shall not be less than 500 psi nor greater than 750 psi at 7 days. Compressive strength at 28-days shall not exceed 1,000 psi. All compressive strength specimens shall be prepared and tested in accordance with ASTM C 192 and ASTM C 39, respectively.*

If the 3-day strength is greater than 500 psi, the Contractor shall construct transverse joints in the econocrete layer in accordance with paragraph 306-5.10.2.

If there is a change in aggregate sources, type of cement used, or pozzolanic materials, a new mix design must be submitted.

306-3.1.2 Air Content. *The percentage of air entrainment shall be 6 percent, plus or minus 1/2 percent. Air content shall be determined by testing in accordance with ASTM C 231 for gravel and stone coarse aggregate and ASTM C 173 for slag and other highly porous coarse aggregate.*

306-3.2 SUBMITTALS*. At least 15 days prior to the placement of the econocrete, the Contractor shall submit certified test reports to the Engineer for those materials proposed for use during construction, as well as the mix design information for the econocrete material. Tests older than 6 months shall not be used. The certification shall show the appropriate ASTM or AASHTO specifications or tests for the material, the name of the company performing the tests, the date of the tests, the test results, and a statement that the material did or did not comply with the applicable specifications. The submittal package shall include the following:*

a. Sources of materials, including aggregate, cement, admixtures, and curing and bond breaking materials.

b. Physical properties of the aggregates, cement, admixtures, curing and bond breaking materials.

c. Mix design.

- *mix identification number.*
- *weight of saturated surface-dry aggregates (fine and coarse).*
- *combined aggregate gradation.*
- *cement factor.*
- *water content.*
- *water-cementitious material ratio (by weight).*
- *volume of admixtures and yield for one cubic yard (cubic meter) of econocrete.*

d. Laboratory test results.

- *slump.*
- *air content.*
- *compressive strength at 3, 7, and 28 days (average values).*
- *wet/dry and/or freeze-thaw weight loss (when applicable).*

In addition, where applicable, the Contractor shall submit for approval by the Engineer a jointing plan for transverse joints in the econocrete layer.

During production, the Contractor shall submit batch tickets for each delivered load.

EQUIPMENT

306-4.1 *All equipment necessary to mix, transport, place, compact, and finish the econocrete material shall be furnished by the Contractor. The equipment shall be subject to inspection and approval by the Engineer.*

306-4.2. MIXING.

306-4.2.1 *Econocrete may be mixed in a stationary mixer, either at a central batch plant or at the site, or in a truck mixer. The mixer type and capacity shall be inspected and approved by the Engineer before production begins. Each mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.*

*306-4.2.1 Stationary Plant Mixer**.** The batch plant and equipment shall conform to the requirements of ASTM C 94. Unrestricted access to the plant must be provided to the Engineer at all times for inspection of the plant's equipment and operation and for sampling the econocrete mixture and its components.*

The mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades.

***306-4.2.2 Truck Mixers**. Truck mixers used for mixing econocrete shall conform to the requirements of ASTM C 94. Econocrete may be entirely mixed in a truck mixer or partially mixed in a stationary mixer with mixing completed in a truck mixer. Truck mixers shall be equipped with an accurate continuous registering electronically or mechanically activated revolution counter, by which the number of drum revolutions may be verified.*

***306-4.3 HAULING.** Mixed econocrete shall be hauled from the stationary plant to the job site in a truck agitator, a truck mixer operating at agitating speed, or a non-agitating truck. All equipment shall conform to the requirements of ASTM C 94. When truck mixers are used to mix econocrete, they may be transported to the job site in the same truck operating at agitating speeds, truck agitators, or a non-agitating truck. The bodies of non-agitating trucks shall be smooth, metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation.*

***306-4.4 PLACING AND FINISHING**.*

***306-4.4.1 Forms.** Straight side forms shall be made of steel and shall be furnished in sections not less than 10 ft in length. Forms shall have a depth equal to the pavement thickness at the edge. Flexible or curved forms of proper radius shall be used for curves of 100-ft radius or less. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating*

and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the Engineer.

The top face of the form shall not vary from a true plane more than ⅛ inch in 10 ft, and the upstanding leg shall not vary more than ¼ in. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when accepted by the Engineer.

306-4.4.2 Pavers. *Econocrete can be placed using fixed forms or slip-form pavers. The paver shall be fully energized, self-propelled and capable of spreading, consolidating, and finishing the econocrete material, true to grade, tolerances, and cross sections. The paver shall be capable of finishing the surface so that hand finishing is not required. The paver shall be of sufficient weight and power to construct the maximum specified concrete paving lane width, at adequate forward speed, without transverse, longitudinal or vertical instability or without displacement. The slip-form paver shall be equipped with electronic or hydraulic horizontal and vertical control devises utilizing guide wires or stringlines on both sides of the machine. Slope control will not be allowed.*

a. Concrete Pavers. Concrete pavers are approved as paver-finishing machines for econocrete, providing they are capable of handling the amount of econocrete required for the full-lane width specified, and consolidating the econocrete full depth. A concrete paver is a power-driven machine with augers, strike-off and tamper bars ahead of a pan screed, with at least one trailing oscillating screed or belt finisher.

b. Bridge Deck Pavers. Bridge deck pavers are approved as paver-finishing machines for econocrete, providing they are capable of handling the amount of econocrete required for the full-lane width specified, and consolidating the econocrete full depth. A bridge deck paver is an automatic truss paving machine, with paving carriage that strikes off, vibrates, paves, and textures the econocrete with augers, internal vibration, paving rollers, and drag pan.

306-4.5 CONSOLIDATION*. For side-form construction, vibrators may be either the surface pan type for pavements less than 8 in thick or the internal type with either immersed tube or multiple spuds for the full width of the slab. They may be attached to the spreader or the finishing machine, or they may be mounted on a separate carriage. They shall not come in contact with the joint, subgrade, or side forms.*

For slip-form construction, the paver shall vibrate the econocrete for the full width and depth of the strip of pavement being placed. Vibration shall be accomplished by internal vibrators.

The number, spacing, frequency, and eccentric weights of vibrators shall be provided as necessary to achieve acceptable consolidation without segregation and finishing quality. Adequate power to operate all vibrators at the weight and frequency required for a satisfactory finish shall be available on the paver. The internal vibrators may be supplemented by vibrating screeds operating on the surface of the econocrete. The Contractor shall constantly monitor the frequency of each of the individual vibrators using electronic means and shall provide constant monitoring of the consolidation process to avoid honeycombing or segregation. Areas that are visually determined to be honeycombed or over-consolidated shall be corrected at the Contractor's expense.

The vibrators and tamping elements shall be automatically controlled so that they stop operation as forward motion ceases. Any override switch shall be of the spring-loaded, momentary-contact type.

Hand held vibrators may be used in irregular areas.

306-4.6 JOINTING. *The Contractor shall provide sawing equipment adequate in number of units and power to produce contraction or construction joints of the required dimensions as shown on the plans. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations.*

CONSTRUCTION METHODS

306-5.1 WEATHER LIMITATIONS.

306-5.1.1 Cold Weather*. Unless authorized by the Engineer, the temperature of the mixed econocrete shall not be less than 50°F (10°C) at the time of placement. In addition, the econocrete shall not be placed when the ambient temperature is below 40°F (4°C) or when conditions indicate that the temperature may fall below 35°F (2°C) within 24 hours. Under no circumstances shall the econocrete be placed on frozen underlying courses or mixed when the aggregate is frozen.*

When mixing and placing is authorized during cold weather, the Engineer may require the water and/or the aggregates to be heated to not less than 70°F (20°C) nor more than 150°F (66°C). The aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

***306-5.1.2 Hot Weather**. To prevent rapid drying of newly constructed econocrete, the econocrete temperature from initial mixing through final cure shall not exceed 90°F (32°C). The aggregates and/or mixing water shall be cooled as necessary to maintain the econocrete temperature at or not more than the specified maximum. Ice or ice water may be substituted for the mixing water for this purpose.*

In addition, during periods of warm weather when the maximum daily air temperature exceeds 85°F (30°C), the forms and/or the underlying material shall be sprinkled with water immediately before placing the econocrete.

***306-5.1.3 Rain**. All mixing and batching operations should be halted during rain showers and any plastic econocrete placed should be covered immediately. The econocrete shall be kept covered with plastic sheeting or other waterproof material until such time that the rain does not make any surface indentation on the econocrete layer. Areas damaged by rain shall be refinished or replaced.*

***306-5.2 FORM SETTING**. Forms shall be set sufficiently in advance of the econocrete placement to ensure continuous paving operation. After the forms have been set to correct grade, the grade shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than 3 pins for each 10-ft section. A pin shall be placed at each side of every joint.*

Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than ¼ in at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of econocrete.

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the econocrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

***306-5.3 PREPARATION OF UNDERLYING COURSE**. The underlying course shall be checked by the Engineer before placing and spreading operations are started, in order to ensure that it is free of any ruts, depressions, or bumps and is finished to the correct grade. Any ruts or soft yielding places in the underlying course caused by improper drainage conditions, hauling, or any other cause, shall be corrected at the Contractor's expense before the econocrete mixture is placed thereon. The underlying course should be wetted down in advance of placing the econocrete to ensure a firm, moist condition at the time of econocrete placement. The underlying course shall be protected from frost. Usage of chemicals to eliminate frost is not permissible.*

***306-5.4 GRADE CONTROL**. Grade control between the edges of the pavement shall be accomplished at intervals of 50 ft or less on the longitudinal grade and at 25 ft or less on the transverse grade. To protect the underlying course and ensure proper drainage, the econocrete paving shall begin along the centerline of the pavement on a crowned section or on the greatest contour elevation of a pavement with variable cross slope.*

***306-5.5 HANDLING, MEASURING, AND BATCHING MATERIAL.** The batch plant site, layout, equipment, and provisions for transporting material shall assure a continuous supply of material to the work. Stockpiles shall be constructed in a manner that prevents segregation and intermixing of deleterious materials.*

Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more than 12 hours transit will be accepted as adequate binning only if the car bodies permit free drainage.

Batching plants shall be equipped to proportion aggregates and bulk cement, by weight, automatically using interlocked proportioning devised of an approved type. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, such as a chute, boot or other device approved by the Engineer, to prevent loss of cement. The device shall be arranged to provide positive assurance that the required cement content is present in each batch.

***306-5.6 MIXING.** All econocrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C 94. The mixing time should be adequate to produce econocrete that is uniform in appearance, with all ingredients evenly distributed. Mixing time shall be measured from the time all materials are emptied into the drum (provided all the water is added before one-fourth the preset mixing time has elapsed) and continues until the time the discharge chute is opened to deliver the econocrete.*

If mixing in a plant, the mixing time shall not be less than 50 nor greater than 90 seconds. If mixing in a truck, the mixing time shall not be less than 70 nor more than 125 truck-drum revolutions at a mixing speed of not less than 6 nor more than 18 truck-drum revolutions per minute.

Retempering econocrete by adding water or by other means will not be permitted, except when econocrete is delivered in truck mixers. With truck mixers, additional water may be added to the batch materials and additional mixing

performed to allow proper placement of the material, provided (a) the addition of water is performed within 45 minutes after the initial mixing operations and (b) the water/cementitious ratio specified in the mix design is not exceeded.

***306-5.7 HAULING**. The elapsed time from the addition of cementitious material to the mix until the econocrete is deposited in place at the work site shall not exceed 45 minutes when the concrete is hauled in nonagitating trucks, nor 90 minutes when it is hauled in truck mixers or truck agitators.*

***306-5.8 PLACING, CONSOLIDATING, AND FINISHING.** Prior to placement of the econocrete layer, the prepared underlying course shall be well moistened with water, without saturating, in order to prevent rapid loss of moisture from the econocrete. In cold weather, the underlying course shall be protected so that it will be entirely free of frost when econocrete is placed.*

The Contractor has the option of side- (fixed-) form or slip-form paving. Under both techniques, the hauled econocrete material shall be discharged onto the prepared underlying course such that segregation of the mix is minimized and minimum handling of the mix is needed. Placement of the econocrete material shall be continuous between construction joints. Workers shall not be allowed to walk in the freshly mixed econocrete with boots or shoes coated with earth or debris.

Econocrete shall not be mixed, placed, or finished when the natural light is insufficient, unless an adequate artificial lighting system is provided.

***306-5.8.1 Side-Form Construction.** For side-form placement, the Contractor shall verify the elevations of the fixed forms such that the thickness and finished grade of the econocrete layer will be in accordance with the requirements of the project plans and specifications. The econocrete shall be spread uniformly between the forms, immediately after it is placed using a spreading machine. Necessary hand spreading shall be done with shovels, not rakes.*

The spreading shall be followed immediately by thorough consolidation using vibrating screeds or spud vibrators. Vibrators may be external or internal type, depending on the thickness of the econocrete layer. The surface vibrators may be attached to the spreader or they may be mounted on a separate carriage. They shall not come in contact with the joint, subgrade, or side forms. When spud vibrators are used, the econocrete shall be thoroughly consolidated against and along the faces of all forms and previously placed econocrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 20 seconds in any one location, nor shall the vibrators be used to move the econocrete.

Hand finishing will not be permitted except in areas where the mechanical finisher cannot operate.

306-5.8.2 Slip-Form Construction. *For slip-form construction, the Contractor shall verify the elevations of the guide wires controlling slip-form pavers such that the thickness and finished grade of the econocrete will be in accordance with the requirements of the project plans and specifications. The slip-form paver should spread, consolidate, and shape the freshly placed econocrete in one complete pass of the machine. The machine shall vibrate and finish the econocrete for the full width and depth of the layer.*

306-5.9 Final Finishing*. Final finishing shall be accomplished while the econocrete is still in the plastic state. Limited surface refinishing by hand is acceptable to meet the grade and surface tolerance established in paragraphs 306-6.2.3 and 306-6.2.4, after strike off and consolidation.*

If the overlying layer is to be PCC pavement, the surface of the econocrete shall not be textured. If the overlying layer is to be HMA pavement, and if the bond between the HMA layer and the econocrete is considered important for pavement performance, tining or scarifying the surface to provide a coarse texture may be permitted.

306-5.10 JOINTS*. Joints shall be constructed as shown on the plans.*

306-5.10.1 Construction Joints*. Locate all longitudinal and transverse construction joints as shown on the plans. If longitudinal joints are not shown, locate longitudinal joints within 6 in from planned joints in the PCC to be placed over the econocrete.*

306-5.10.2 Contraction Joints*. If required by paragraph306-3.1.1or if shown on the plans, transverse contraction joints shall be constructed by sawing the hardened econocrete to a depth of at least one-third the thickness of the econocrete base. These joints shall match within 3 in the planned joints of the overlying concrete surface.*

306-5.10.3 Concrete Saws. *When sawing of joints are specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. The Contractor shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be on the job both before and at all times during econocrete placement.*

***306-5.11 CURING**. Immediately after the finishing operations are complete and within 2 hours of placement of the econocrete, the entire surface and edges of the newly placed econocrete shall be sprayed uniformly with white pigmented, liquid membrane forming curing compound. The layer should be kept moist using a moisture-retaining cover or a light application of water until the curing material is applied. The curing compound shall not be applied during rainfall.*

The curing material shall be applied using mechanical sprayers under pressure at the rate of 1 gal to not more than 200 ft^2. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound in the tank shall be in a thoroughly mixed condition with the pigment uniformly distributed throughout the vehicle. During application the compound shall be stirred continuously by mechanical means.

Hand spraying of odd widths or shapes and econocrete surfaces exposed by the removal of forms is permitted.

Should the film of curing material become damaged from any cause, including sawing operations, within the required 28-day curing period or until the overlying course is constructed, the damaged portions shall be repaired immediately with additional compound or other approved means as quickly as practical.

Edges of the econocrete layer shall be sprayed with curing compound immediately following placement with slip-form pavers or when side-forms are removed.

***306-5.11.1 Curing in Cold Weather**. The econocrete shall be maintained at a temperature of at least 50°F (10°C) for a period of 72 hours after placing and at a temperature above freezing for the remainder of the curing time. The Contractor shall be responsible for the quality and strength of the econocrete placed during cold weather, and any econocrete injured by frost action shall be removed and replaced at the Contractor's expense.*

***306-5.11.2 Curing in Hot Weather.** When econocrete is being placed and the air temperature may be expected to rise above 90°F (32°C) shortly after placement, the econocrete layer should be cured as quickly as possible to allow curing without the formation of excessive shrinkage cracks.*

***306-5.12 PROTECTION**. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents. The Engineer shall decide when the pavement shall be opened to traffic. Traffic shall not be allowed on the pavement until test specimens molded and cured in accordance with ASTM C 31 have attained a compressive strength of 350 psi when tested by ASTM C 39. The econocrete surface shall be protected from foot and vehicular traffic and other sources of*

abrasion until such a time. During this time, the econocrete layer shall be protected from injurious action by sun, rain, flowing water, frost, or mechanical injury. After this period, construction traffic to place the overlying layers may be allowed.

***306-5.13 BOND-BREAKER**. When the econocrete is to be placed directly beneath PCC pavement, a bond-breaker shall be used. The entire surface of the econocrete shall be coated with a de-bonding compound applied in a quality sufficient to prevent bonding of the PCC pavement to the econocrete. If an impervious membrane or asphalt emulsion is used as a curing material, additional applications of curing materials may be required. The Contractor shall be responsible for selecting the de-bonding compound and determining the necessary application rate. The de-bonding compound shall be approved by the Engineer prior to being incorporated into the work. This application shall be made at least 8 hours and not more than 24 hours prior to beginning the placement of the PCC pavement. The rate of application shall be the same as that specified for the curing application. After application of the bond-breaker coat, traffic will be limited to that required for the placement of the overlying pavement layer.*

A ¼-inch thick layer of fine sand distributed evenly over the econocrete surface ahead of the PCC paver will be an acceptable bond-breaker.

MATERIAL ACCEPTANCE

***306-6.1 ACCEPTANCE SAMPLING AND TESTING.** All acceptance sampling and testing, with the exception of coring for thickness determination, necessary to determine conformance with the requirements specified in this section will be performed by the Engineer. The Contractor shall provide the required econocrete samples during construction for acceptance testing purposes. The samples shall be taken in the presence of the Engineer.*

The econocrete layer shall be tested for air content, strength, thickness, grade, and surface tolerance. Sampling and testing for air shall be as specified in paragraph 306-6.1.1. Sampling and testing for strength, thickness, grade, and surface tolerance shall be on a lot basis, with a lot consisting of one of the following:

- *One day's production not to exceed 2,000 yd^2.*
- *A half day's production, where a day's production is expected to consist of between 2,000 and 4,000 yd^2.*

Each lot will be divided into four equal sublots. In the event that only three (3) sublots are produced, the three sublots shall constitute a complete lot. If, only one (1) or two (2) sublots are produced, they shall be incorporated into the next

lot, and the total number of sublots shall be used in the acceptance plan calculation.

End-of-production sublots (i.e., sublots associated with the final placement of econocrete for the project and are less than a complete lot) shall be handled as:

- *Three (3) sublots shall constitute a lot.*
- *One (1) or (2) sublots shall be incorporated into the previous lot.*

***306-6.1.1 Air Content Testing**. Air content tests shall be performed on the first three truckloads of econocrete produced at the start of operations each day and the first three truckloads produced after any scheduled or non-scheduled shutdown. Additional tests shall be performed each time a sample is taken for a strength test and when requested by the Engineer.*

Air content tests shall be made in accordance with ASTM C 231. Air content test results shall be between 4 and 8 percent.

If the first test on a truckload of econocrete is not within the specification limits, a second test on the same truckload shall be made. If the second test is within the specification limits, the econocrete will be accepted with respect to entrained air content. If the second test is not within the specification limits, the truckload shall be rejected.

***306-6.1.2 Compressive Strength Testing**. One sample of freshly delivered econocrete shall be taken from each sublot for compressive strength testing. The econocrete shall be sampled in accordance with ASTM C 172. Sampling locations shall be determined in accordance with the random sampling procedures contained in ASTM D 3665.*

At least two (2) test cylinders shall be made from each sample in accordance with ASTM C 31. The 7-day and 28-day compressive strength of each cylinder shall be determined in accordance with ASTM C 39.

Since the strength level of econocrete at an early age is considerably lower than PCC, special care is required in handling test specimens.

The Contractor shall provide adequate facilities for the initial curing of cylinders. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60 to 80°F (16 to 27°C), and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather or in heavyweight closed plastic bags, or use other suitable methods, provided the temperature and moisture loss requirements are met.

The compressive strength for each sublot shall be computed by averaging the 7-day and 28-day compressive strengths of the two test cylinders representing that sublot. The compressive strength of the lot shall be the average compressive strength of the individual sublots comprising the lot.

Specimens that are noticeably defective shall not be considered in the determination of the strength. If the test specimens fail to conform to the requirements for strength, the Engineer shall request changes in the econocrete mixture to increase the strength to meet the requirements.

If the maximum 7-day or 28-day compressive strength values exceed the maximum strength requirements when evaluated in accordance with paragraph 306-6-2.1, the Contractor shall propose a jointing plan for approval by the Engineer.

306-6.1.3 Thickness Testing. *After the econocrete base has cured for 3 days, one (1) 4-in diameter core per sublot shall be obtained from a random location, as identified using the procedures contained in ASTM D 3665. The thickness of each sampled core shall be determined using the caliper measurement procedures provided by ASTM C 174. The average thickness for the lot shall be determined using the individual sublot core thicknesses. Acceptance criteria for econocrete thickness are provided in paragraph 306-6.2.2.*

When such measurement is deficient more than ½ in and not more than 1 in from the plan thickness, two additional cores shall be taken at random and used in determining the average thickness for that lot. The thickness of the cores shall be determined by average caliper measurement of cores tested in accordance with ASTM C 174.

At all locations where cores have been drilled, the resulting holes shall be filled with econocrete or non-shrink grout material, as approved by the Engineer.

306-6.1.4 Grade Testing. *The elevations of the finished econocrete shall be surveyed on both sides of the econocrete lane, every 25 ft.*

306-6.1.5 Surface Tolerance Testing. *After the econocrete has hardened sufficiently, it shall be tested for surface tolerance with a 16-ft straightedge provided by the Contractor.*

306-6.2 ACCEPTANCE CRITERIA. *Acceptance of econocrete will be based on compressive strength, thickness, grade, and surface tolerance, as described in the paragraphs below.*

306-6.2.1 Compressive Strength Requirements. *The econocrete shall meet all of the following compressive strength requirements on a lot basis:*

- *The compressive strength of the lot, tested at 7 days, shall be greater than 500 psi. When a given lot of econocrete fails to meet the minimum compressive strength requirements, the entire lot shall be replaced at the Contractor's expense.*
- *Not more than 20 percent of the individual cylinders in a given lot, tested at 7 days, shall have a compressive strength greater than 750 psi, or greater than 1,000 psi at 28-days . When greater than 20 percent of the individual cylinders in a given lot have 7-day compressive strengths in excess of 750 psi, or have 28-day compressive strengths in excess of 1,000 psi, transverse joints shall be constructed.*

- *Econocrete that fails to meet the lower end compressive strength requirements will be removed and replaced at the Contractor's expense.*

306-6.2.2 Thickness Requirements. *The completed thickness shall be as shown on the plans. When the average lot thickness is not deficient by more than ½ in from the plan thickness, full payment shall be made. If the lot average thickness is deficient by more than 1 in, it shall be removed and replaced at the Contractor's expense. When such measurement is deficient more than ½ in and not more than 1 in from the plan thickness, one additional core shall be taken at random from each sublot within the lot. The thickness of these additional cores shall be determined as indicated in paragraph 304-6.1.2. A new lot average thickness shall be recomputed based on these additional cores and the original cores taken from each sublot. When the recomputed average lot thickness is not deficient by more than ½ in from the plan thickness, full payment shall be made. If the average lot thickness is deficient by more than ½ in from the plan thickness, the entire lot shall be removed and replaced at the Contractor's expense or shall be permitted to remain in place at an adjusted payment of 75 percent of the contract unit price.*

When the measured thickness is more than that indicated on the plans, it will be considered as conforming to the requirements, provided the surface of the completed econocrete layer is within the established grade and surface tolerance requirements.

306-6.2.3 Grade Requirements*. When the completed surface is more than ½ in above the grade shown in the plans, the surface shall be trimmed at the Contractor's expense using an approved grinding machine to an elevation that falls within a tolerance of ¼ in. The ground surface shall be sprayed with curing compound at double the rate specified prior to paving.*

306-6.2.4 Surface Tolerance Requirements. *Surface deviations shall not exceed ⅜ in from a 16-ft straightedge laid in any location parallel with or at right angles to the longitudinal axis of the centerline (includes along all edges of the paving lane). Any high spots of more than ⅜ inch in 16 ft shall be marked and immediately trimmed with an approved grinding machine. If the overlying layer is PCC pavement, the ground surface shall be sprayed with a double application of the curing compound at the specified rate prior to paving.*

METHOD OF MEASUREMENT

306-7.1 *See Section 33-2.*

BASIS OF PAYMENT

306-8.1 *See Section 33-3.*

TESTING REQUIREMENTS

ASTM C 31	*Making and Curing Concrete Test Specimens in the Field*
ASTM C 39	*Compressive Strength of Cylindrical Concrete Specimens*
ASTM C 136	*Sieve or Screen Analysis of Fine and Course Aggregates*
ASTM C 172	*Sampling Freshly Mixed Concrete*
ASTM C 173	*Air Content of Freshly Mixed Concrete by the Volumetric Method*
ASTM C 174	*Measuring Length of Drilled Concrete Cores*
ASTM C 192	*Making and Curing Concrete Test Specimens in the Laboratory*
ASTM C 231	*Air Content of Freshly Mixed Concrete by the Pressure Method*
ASTM D 560	*Standard Test Methods for Freezing and Thawing Compacted Soil-Cement Mixtures*
ASTM D 3665	*Random Sampling of Paving Materials*
AASHTO T 26	*Quality of Water to be Used in Concrete*

MATERIAL REQUIREMENTS

ASTM C 33	*Specification for Concrete Aggregates*
ASTM C 94	*Specification for Ready-Mixed Concrete*
ASTM C 150	*Specification for Portland Cement*
ASTM C 260	*Specification for Air-Entraining Admixtures for Concrete*
ASTM C 309	*Specification for Liquid Membrane-Forming Compounds for Curing Concrete*
ASTM C 494	*Specification for Chemical Admixtures for Concrete*
ASTM C 595	*Standard Specification for Blended Hydraulic Cements*
ASTM C 618	*Specification for Fly Ash and Raw and Calcined Natural Pozzolans for Use in Portland Cement Concrete*
ASTM C 989	*Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars*

END P-306

33-2 METHOD OF MEASUREMENT

The quantity of econocrete to be paid for will be determined by the number of square yards of econocrete actually constructed and accepted by the Engineer as complying with the plans and specifications.

Sawcutting for excessive strength econocrete will not be measured for payment but will be considered to be an incidental to the Contractor's price for remediation for providing excessive strength material.

Bond-breaker will not be measured for payment but will be considered to be an incidental to Econocrete Base Course.

33-3 BASIS OF PAYMENT

The accepted quantities of econocrete will be paid for at the contract unit price per square yard for econocrete base. The price and payment shall be full compensation for furnishing and

placing all materials, provided; however, for any pavement found deficient in thickness as specified in paragraph 306-6.2.2, the reduced unit price shall be paid.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

Item 33.1 Econocrete Base Course .....per square yard

END OF SECTION 33

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SECTION 34 – PLANT MIX BITUMINOUS PAVEMENTS – SURFACE COURSE (FAA P-401)

34-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of plant mix bituminous pavement as surface course for runways or taxiways in accordance with Sections 203 and 302 of the Standard Specifications, except as specified otherwise in FAA Specification Item P-401, Plant Mix Bituminous Pavements, as included and modified hereafter, and other referenced documents, and as shown on the Plans.

Bituminous base course, or bituminous surface course for roadways and for runway, taxiway, and apron shoulders is covered under Section 36 of these specifications (FAA P-403)

ITEM P-401 PLANT MIX BITUMINOUS PAVEMENTS

DESCRIPTION

401-1.1 *This item shall consist of pavement courses composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.*

MATERIALS

401-2.1 AGGREGATE. *Aggregates shall consist of crushed stone, crushed gravel, or crushed slag with or without natural sand or other inert finely divided mineral aggregate. The portion of combined materials retained on the No. 4 sieve is coarse aggregate. The portion of combined materials passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate, and the portion passing the No. 200 sieve is mineral filler.*

a. Coarse Aggregate. *Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances. The percentage of wear shall not be greater than 40 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 10 percent, or the magnesium sulfate soundness loss shall not exceed 13 percent, after five cycles, when tested in accordance with ASTM C 88.*

Aggregate shall contain at least 70 percent by weight of individual pieces having two or more fractured faces and 85 percent by weight having at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be obtained by crushing.

The aggregate shall not contain more than a total of 8 percent, by weight, of flat particles, elongated particles, and flat and elongated particles, when tested in accordance with ASTM D 4791 with a value of 5:1.

b. Fine Aggregate. *Fine aggregate shall consist of clean, sound, durable, angular shaped particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clay, silt, or other objectionable matter and shall contain no clay balls. The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.*

Natural (nonmanufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. The fine aggregate shall not contain more than 15 percent natural sand by weight of total aggregates. If used, the natural sand shall meet the requirements of ASTM D 1073 and shall have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.

The aggregate shall have sand equivalent values of 45 or greater when tested in accordance with ASTM D 2419.

c. Sampling. *ASTM D 75 shall be used in sampling coarse and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler.*

d. Sources of Aggregates. *Sources of aggregates shall be selected well in advance of the time the materials are required in the work. When the aggregates are obtained from a previously approved source, or an existing source producing aggregates that has a satisfactory service record in airport bituminous pavement construction for at least 5 years, samples shall be submitted 21 days prior to start of production. An inspection of the producer's operation will be made by the Engineer. When new sources are to be developed, the Contractor shall indicate the sources and shall submit a plan for operation 30 days in advance of starting production. Samples from test pits, borings, and other excavations shall be submitted at the same time. Approval of the source of aggregate does not relieve the Contractor in any way of the responsibility for delivery at the job site of aggregates that meet the requirements specified herein.*

e. Samples of Aggregates*. Samples of aggregates shall be furnished by the Contractor at the start of production, and at intervals during production of bituminous mixtures. The sampling points and intervals will be designated by the Engineer. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this section. The Contractor shall furnish documentation and samples to the Engineer confirming that the aggregates meet the specification requirements.*

401-2.2 MINERAL FILLER. *If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.*

401-2.3 ASPHALT CEMENT BINDER.

Asphalt cement binder shall conform to ASTM D6373 Performance Grade (PG) [ ]. A certificate of compliance from the manufacturer shall be included with the mix design submittal.

The supplier's certified test report with test data indicating grade certification for the asphalt binder shall be provided to the Engineer for each load at the time of delivery to the mix plant. A certified test report with test data indicating grade certification for the asphalt binder shall also be provided to the Engineer for any modification of the asphalt binder after delivery to the mix plant and before use in the HMA.

The Engineer should use the following guidance in selecting the asphalt cement PG to include in the above paragraph.

a. *The initial PG asphalt cement binder should be consistent with the recommendations of the applicable State Department of Transportation requirements for Interstate pavement prior to bumping.*
Additional guidance on selecting the asphalt cement binder PG prior to bumping include the following:

(1) *Asphalt Institute MS-26, The Asphalt Binder Handbook.*
(2) *The Asphalt Institute's State Binder Specification Database at: http://www.asphaltinstitute.org/public/engineering/state_binder_specs/index.dot.*
(3) *The Long Term Pavement Performance Binder program at http://www.infopave.com/Page/Index/LTPP_BIND.*

b. *Using the initial PG selected, apply the applicable grade bump in accordance with the table below; which will determine the PG that will be inserted in the above paragraph.*

Required Grade Bump

Aircraft Gross Weight	*High Temperature Adjustment to Binder Grade*
	All Pavement Types
≤ 12,500 lbs (5670 kg)	*--*
< 100,000 lbs (45360 kg)	*1 Grade*
≥ 100,000 lbs (45360 kg)	*2 Grade*
Typically, rutting is not a problem on airport pavements. However, at airports with a history of stacking on end of runways and taxiway areas, rutting has occurred due to the slow speed of loading on the pavement. If there has been rutting on the project or it is anticipated that stacking may occur during the design life of the project, then the following grade bumping should be applied for the top 5 inches (125 mm) of paving in the end of runway and taxiway areas: for aircraft tire pressure between 100 and 200 psi (0.7 and 1.4 MPa), increase the high temperature one grade; for aircraft tire pressure greater than 200 psi (1.4 MPa), increase the high temperature two grades. The low temperature grade should remain the same.	

PG grades above a –22 on the low end (e.g., PG XX–16 or PG XX-10) are not recommended. Limited experience has shown an increase in block cracking with -16 or -10 grade asphalts.

Typically, when the PG spread between the high and low temperature is 92 or more, the asphalt cement binder has been modified. A PG Plus Test will be required to determine if the asphalt cement binder has been properly modified. Use the PG Plus Test found in the Asphalt Institute's State Binder Specification Database for the project location. When a State does not specify a PG Plus Test, use ASTM D6084 with a minimum elastic recovery of 70%.

401-2.4 PRELIMINARY MATERIAL ACCEPTANCE. *Prior to delivery of materials to the job site, the Contractor shall submit certified test reports to the Engineer for the following materials:*

a. Coarse Aggregate.

(1) *Percent of wear.*
(2) *Soundness.*
(3) *Unit weight of slag.*
(4) *Percent fractured faces.*

b. Fine Aggregate.

(1) *Liquid limit.*
(2) *Plasticity index.*
(3) *Sand equivalent.*

c. Mineral Filler.

d. Bituminous Material. *Test results for bituminous material shall include temperature/viscosity charts for mixing and compaction temperatures.*

The certification(s) shall show the appropriate ASTM test(s) for each material, the test results, and a statement that the material meets the specification requirement.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

401-2.5 ANTI-STRIPPING AGENT. *Any anti-stripping agent or additive if required shall be heat stable, shall not change the asphalt cement viscosity beyond specifications, shall contain no harmful ingredients, shall be added in recommended proportion by approved method, and shall be a material approved by the Department of Transportation of the State in which the project is located.*

COMPOSITION

401-3.1 COMPOSITION OF MIXTURE. *The bituminous plant mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and*

bituminous material. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).

401-3.2 JOB MIX FORMULA. *No bituminous mixture for payment shall be produced until a job mix formula has been approved in writing by the Engineer. The bituminous mixture shall be designed using procedures contained in Chapter 5, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No. 2 (MS-2), Mix Design Methods for Asphalt Concrete, sixth edition.*

The design criteria in Table 1 are target values necessary to meet the acceptance requirements contained in paragraph 401-5.2b. The criteria is based on a production process which has a material variability with the following standard deviations:

Stability (lbs.) = 270
Flow (0.01 inch) = 1.5
Air Voids (%) = 0.65

If material variability exceeds the standard deviations indicated, the job mix formula and subsequent production targets shall be based on a stability greater than shown in Table 1, and the flow and air voids shall be targeted close to the mid-range of the criteria in order to meet the acceptance requirements.

Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867, shall not be less than 75. Anti-stripping agent shall be added to the asphalt, as necessary, to produce a TSR of not less than 75. If an antistrip agent is required, it will be provided by the Contractor at no additional cost to the Owner.

The job mix formula shall be submitted in writing by the Contractor to the Engineer at least 15 days prior to the start of paving operations and shall include as a minimum:

a. *Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percent by weight of each stockpile used in the job mix formula.*

b. *Percent of asphalt cement.*

c. *Asphalt performance, viscosity or penetration grade, and type of modifier if used.*

d. *Number of blows of hammer compaction per side of molded specimen.*

e. *Mixing temperature.*

f. *Compaction temperature.*

g. *Temperature of mix when discharged from the mixer.*

h. *Temperature-viscosity relationship of the asphalt cement.*

i. *Plot of the combined gradation on the Federal Highway Administration (FHWA) 45 power gradation curve.*

j. *Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content.*

k. *Percent natural sand.*

l. *Percent fractured faces.*

m. *Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).*

n. *Tensile Strength Ratio (TSR).*

o. *Antistrip agent (if required).*

p. *Date the job mix formula was developed.*

The Contractor shall submit to the Engineer the results of verification testing of three (3) asphalt samples prepared at the optimum asphalt content. The average of the results of this testing shall indicate conformance with the job mix formula requirements specified in Tables 1, 2 and 3.

When the project requires asphalt mixtures of differing aggregate gradations, a separate job mix formula and the results of job mix formula verification testing must be submitted for each mix.

The job mix formula for each mixture shall be in effect until a modification is approved in writing by the Engineer. Should a change in sources of materials be made, a new job mix formula must be submitted within 10 days and approved by the Engineer in writing before the new material is used. After the initial production job mix formula(s) has/have been approved by the Engineer and a new or modified job mix formula is required for whatever reason, the subsequent cost of the Engineer's approval of the new or modified job mix formula will be borne by the Contractor. There will be no time extension given or considerations for extra costs associated with the stoppage of production paving or restart of production paving due to the time needed for the Engineer to approve the initial, new or modified job mix formula.

TABLE 1. ***MARSHALL DESIGN CRITERIA***	
TEST PROPERTY	
Number of blows	*75*
Stability, pounds minimum	*2,150*
Flow, 0.01 in.	*10-14*
Air voids (percent)	*2.8 – 4.2*

Percent voids in mineral aggregate, minimum	*See Table 2*

TABLE 2 *MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE*	
Maximum Particle Size	*Minimum Voids in Mineral Aggregate*
in.	*Percent*
1/2	*14*
3/4	*13*
1	*12*
1-1/4	*11*

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM C 136 and C 117.

The gradations in Table 3 represent the limits that shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in the JMF), shall have a gradation within the limits designated in Table 3 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine.

Table 3 ***AGGREGATE – BITUMINOUS PAVEMENTS – SURFACE COURSE***			
Sieve Size	***Percentage by Weight Passing Sieves***		
	1-1/4 inch Max	***1 inch Max***	***¾ inch Max***
1-1/4 in.	*100*	*-*	*-*
1 in.	*86—98*	*100*	*-*
¾ in.	*68—93*	*76-98*	*100*
½ in.	*57—81*	*66-86*	*79-99*
3/8 in.	*49—69*	*57-77*	*68-88*
No. 4	*34—54*	*40-60*	*48-68*
No. 8	*22—42*	*26-46*	*33-53*
No. 16	*13—33*	*17-37*	*20-40*
No. 30	*8—24*	*11-27*	*14-30*
No. 50	*6—18*	*7-19*	*9-21*

Table 3 AGGREGATE – BITUMINOUS PAVEMENTS – SURFACE COURSE			
Sieve Size	***Percentage by Weight Passing Sieves***		
No. 100	*4—12*	*6-16*	*6-16*
No. 200	*3—6*	*3-6*	*3-6*
Asphalt percent	*4.5—7.0*	*4.5-7.0*	*5.0-7.5*

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute Manual Series No. 2 (MS-2), Chapter 3.

401-3.3 RECYCLED ASPHALT CONCRETE. *If approved for use on the project, recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 2 inches. The recycled HMA mix shall be designed using procedures contained in AI MS-02. The recycled asphalt concrete mix shall be designed using procedures contained in the Asphalt Institute's Manual Series Number 2 (MS-2). The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D 2172 using the appropriate dust correction procedure. The job mix shall meet the requirements of paragraph 401-3.2 RAP should only be used for shoulder surface course mixes and for any intermediate courses. The amount of RAP shall be limited to 30 percent.*

In addition to the requirements of paragraph 401-3.2, the job mix formula shall indicate the percent of reclaimed asphalt pavement and the percent and viscosity grade of new asphalt. The Contractor shall submit documentation to the Engineer, indicating that the mixing equipment proposed for use is adequate to mix the percent of RAP shown in the job mix formula and meet all local and national environmental regulations.

The blend of new asphalt cement and the RAP asphalt binder shall meet the requirements in paragraph 401-2.3. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph 401-2.3

401-3.4 TEST SECTION. *Prior to full production, the Contractor shall prepare and place a quantity of bituminous mixture according to the job mix formula. The amount of mixture shall be sufficient to construct a test section 300 feet long and 20 feet wide, placed in two lanes, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. A cold joint is an exposed construction joint at least 4 hours old or whose mat has cooled to less than 160° F. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test*

section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.

The test section shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 401-5.1 and 401-6.3. the test section shall be divided into equal sublots. as a minimum the test section shall consist of 3 sublots.

The test section shall be considered acceptable if; 1) stability, flow, mat density, air voids, and joint density are 90 percent or more within limits, 2) gradation and asphalt content are within the action limits specified in paragraphs 401-6.5a and 5b, and 3) the voids in the mineral aggregate are within the limits of Table 2.

If the initial test section should prove to be unacceptable, the necessary adjustments to the job mix formula, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. If the second test section also does not meet specification requirements, both sections shall be removed at the Contractor's expense. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Any additional sections that are not acceptable shall be removed at the Contractor's expense. Full production shall not begin until an acceptable section has been constructed and accepted in writing by the Engineer. Once an acceptable test section has been placed, payment for the initial test section and the section that meets specification requirements shall be made in accordance with paragraph 401-8.1.

Job mix control testing shall be performed by the Contractor at the start of plant production and in conjunction with the calibration of the plant for the job mix formula. If aggregates produced by the plant do not satisfy the gradation requirements or produce a mix that meets the JMF. It will be necessary to reevaluate and redesign the mix using plant-produced aggregates. Specimens shall be prepared and the optimum bitumen content determined in the same manner as for the original design tests.

Contractor will not be allowed to place the test section until the Contractor Quality Control Program, showing conformance with the requirements of Paragraph 401-6.1, has been approved, in writing, by the Engineer.

401-3.5 TESTING LABORATORY. *The Contractor's laboratory used to develop the job mix formula shall meet the requirements of ASTM D 3666 including the requirement to be accredited by a national authority such as the National Voluntary Laboratory Accreditation Program (NVLAP), the American Association for Laboratory Accreditation (AALA), or AASHTO Accreditation Program (AAP). Laboratory personnel shall meet the requirements of Section 12 (FAA 100) of the General Provisions. A certification signed by the manager of the laboratory stating that it meets these requirements shall be submitted to the Engineer prior to the start of construction. The certification shall contain as a minimum:*

a. *Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.*

b. *A listing of equipment to be used in developing the job mix.*

c. *A copy of the laboratory's quality control system.*

d. *Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.*

e. *ASTM D 3666 certification of accreditation by a nationally recognized accreditation program.*

CONSTRUCTION METHODS

401-4.1 WEATHER LIMITATIONS. *The bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the Engineer, if requested; however, all other requirements including compaction shall be met.*

Table 4 *BASE TEMPERATURE LIMITATIONS*	
Mat Thickness	***Deg. F (Deg. C)***
3 in. or greater	*40 (4)*
Greater than 1 in. but less than 3 in.	*45 (7)*
1 in. or less	*50 (10)*

401-4.2 BITUMINOUS MIXING PLANT. *Plants used for the preparation of bituminous mixtures shall conform to the requirements of ASTM D 995 with the following changes:*

a. Requirements for All Plants.

(1) Truck Scales. *The bituminous mixture shall be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy. Scales shall conform to the requirements of the General Provisions, Section 90-01.*

In lieu of scales, and as approved by the Engineer, asphalt mixture weights may be determined by the use of an electronic weighing system equipped with an automatic printer that weighs the total paving mixture. Contractor must furnish calibration certification of the weighing system prior to mix production and as often thereafter as requested by the Engineer.

(2) Testing Facilities. *The Contractor shall provide laboratory facilities at the plant for the use of the Engineer's acceptance testing and the Contractor's quality control testing. The Engineer will always have priority in the use of the laboratory. The*

lab shall have sufficient space and equipment so that both testing representatives (Engineer's and Contractor's) can operate efficiently. The lab shall also meet the requirements of ASTM D 3666.

The plant testing laboratory shall have a floor space area of not less than 150 square feet, with a ceiling height of not less than 7-½ feet. The laboratory shall be weather tight, sufficiently heated in cold weather, air-conditioned in hot weather to maintain temperatures for testing purposes of 70 degrees F +/- 5 degrees F. The plant testing laboratory shall be located on the plant site to provide an unobstructed view, from one of its windows, of the trucks being loaded with the plant mix materials.

Laboratory facilities shall be kept clean, and all equipment shall be maintained in proper working condition. The Engineer shall be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

As a minimum, the plant testing laboratory shall have:

- ***(a)*** *Adequate artificial lighting*
- ***(b)*** *Electrical outlets sufficient in number and capacity for operating the required testing equipment and drying samples.*
- ***(c)*** *Fire extinguishers (2), Underwriter's Laboratories approved*
- ***(d)*** *Work benches for testing, minimum 2-½ feet by 10 feet.*
- ***(e)*** *Desk with 2 chairs*
- ***(f)*** *Sanitary facilities convenient to testing laboratory*
- ***(g)*** *Exhaust fan to outside air, minimum 12 inch blade diameter*
- ***(h)*** *A direct telephone line and telephone including a FAX machine operating 24 hours per day, seven days per week*
- ***(i)*** *File cabinet with lock for Engineer*
- ***(j)*** *Sink with running water, attached drain board and drain capable of handling separate material*
- ***(k)*** *Metal stand for holding washing sieves*
- ***(l)*** *Two element hot plate or other comparable heating device, with dial type thermostatic controls for drying aggregates*
- ***(m)*** *Mechanical shaker and appropriate sieves (listed in JMF, Table 3) meeting the requirements of ASTM E-11 for determining the gradation of coarse and fine aggregates in accordance with ASTM C 136*
- ***(n)*** *Marshall testing equipment meeting ASTM D 6926, ASTM D 6927, automatic compaction equipment capable of compacting three specimens at once and other apparatus as specified in ASTM C 127, D 2172, D 2726, and D 2041*
- ***(o)*** *Oven, thermostatically controlled, inside minimum 1 cubic foot*
- ***(p)*** *Two volumetric specific gravity flasks, 500 cc*
- ***(q)*** *Other necessary hand tools required for sampling and testing*

(r) *Library containing contract specifications, latest ASTM volumes 4.01, 4.02, 4.03 and 4.09, AASHTO standard specification parts I and II, and Asphalt Institute Publication MS-2.*

(s) *Equipment for Theoretical Specific Gravity testing including a 4,000 cc pycnometer, vacuum pump capable of maintaining 30 ml mercury pressure and a balance, 16-20 kilograms with accuracy of 0.5 grams*

(t) *Extraction equipment, centrifuge and reflux types and ROTOflex equipment*

(u) *A masonry saw with diamond blade for trimming pavement cores and samples*

(v) *Telephone*

Approval of the plant and testing laboratory by the Engineer requires all facilities and equipment to be in good working order during production, sampling and testing. Failure to provide the specified facilities shall be sufficient cause for disapproving bituminous plant operations.

The Owner shall have access to the lab and the plant whenever Contractor is in production.

(3) Inspection of Plant. *The Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.*

(4) Storage Bins and Surge Bins. *Use of surge and storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:*

(a) *The bituminous mixture may be stored in surge bins for* ***a*** *period of time not to exceed 3 hours.*

(b) *The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours****.***

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

*If the Engineer determines that there is an excessive amount of heat loss, segregation****,*** *or oxidation of the mixture due to temporary storage, no temporary storage will be allowed.*

401-4.3 HAULING EQUIPMENT. *Trucks used for hauling bituminous mixtures shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the*

specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

401-4.4 BITUMINOUS PAVERS. *Bituminous pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of bituminous plant mix material that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.*

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

The controls shall be capable of working in conjunction with any of the following attachments:

- ***a.*** *Ski-type device of not less than 30 feet (9.14 m) in length.*
- ***b.*** *Taut stringline (wire) set to grade.*
- ***c.*** *Short ski or shoe.*
- ***d.*** *Laser control.*

If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and satisfactory equipment shall be provided by the Contractor.

401-4.5 ROLLERS. *Rollers of the vibratory, steel wheel, and pneumatic-tired type shall be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.*

All rollers shall be specifically designed and suitable for compacting hot mix bituminous concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used. Depressions in pavement surfaces caused by rollers shall be repaired by the Contractor at its own expense.

The use of equipment that causes crushing of the aggregate will not be permitted.

a. Nuclear Densometer. *The Contractor shall have on site a nuclear densometer during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall also supply a qualified technician during all paving operations to calibrate the nuclear densometer and obtain accurate density readings for all new bituminous concrete. These densities shall be supplied to the Engineer upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.*

401-4.6 PREPARATION OF BITUMINOUS MATERIAL. *The bituminous material shall be heated in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325 degrees F (160 degrees C), unless otherwise required by the manufacturer.*

401-4.7 PREPARATION OF MINERAL AGGREGATE. *The aggregate for the mixture shall be heated and dried prior to introduction into the mixer. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F (175 degrees C) when the asphalt is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.*

401-4.8 PREPARATION OF BITUMINOUS MIXTURE. *The aggregates and the bituminous material shall be weighed or metered and introduced into the mixer in the amount specified by the job mix formula.*

The combined materials shall be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95 percent of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all bituminous mixtures upon discharge shall not exceed 0.5 percent.

401-4.9 PREPARATION OF THE UNDERLYING SURFACE. *Immediately before placing the bituminous mixture, the underlying course shall be cleaned of all dust and debris. A prime coat or tack coat shall be applied in accordance with Sections 39 and 40 of these specifications (FAA Items P-602 or P-603, respectively). A tack coat shall be applied in accordance with Section 33 (FAA Item P-603) when paving on existing paved*

surfaces, including asphalt base course, and between all lifts of multiple lift asphalt paving.

401-4.10 LAYDOWN PLAN, TRANSPORTING, PLACING, AND FINISHING. *Prior to the placement of the bituminous mixture, the Contractor shall prepare a laydown plan for approval by the Engineer. This is to minimize the number of cold joints in the pavement. The laydown plan shall include the sequence of paving laydown by stations, width of lanes, temporary ramp location(s), and laydown temperature. The laydown plan shall also include estimated time of completion for each portion of the work (i.e. milling, paving, rolling, cooling, etc.). Modifications to the laydown plan shall be approved by the Engineer.*

The bituminous mixture shall be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 401-4.3. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

For all runway, taxiway and apron pavements, Contractor shall use a stringline to place each lane of each lift of bituminous surface course. However, at the Contractor's option, Contractor shall use stringline for first lift of bituminous surface course and then survey the grade of that lift. Provided grades of that lift of bituminous surface course meet the tolerances of paragraphs 401-5.2b(6), then Contractor may place successive lifts of bituminous surface course using a long ski, or laser control per paragraph 401-4.4. However, Contractor shall survey each lift of bituminous surface course and certify to Engineer that every lot of each lift meets the grade tolerances of paragraph 401-5.2b(6) before the next lift can be placed without a stringline. If the grades of a single lot do not meet the tolerances of 401-5.2b(6), then the Contractor shall use a stringline for each entire lift. Corrective action in paragraph 401-5.2b(6) applies to the final lift of surface course; however, for multiple lift construction, the Contractor shall correct to ensure the final lift of surface course is a minimum of 3 inches and a maximum of 4 inches.

The Contractor may elect to use a material transfer vehicle to deliver mix to the paver.

Paving during nighttime construction shall require the following:

a. *All paving machines, rollers, distribution trucks and other vehicles required by the Contractor for his operations shall be equipped with artificial illumination sufficient to safely complete the work.*

b. *Minimum illumination level shall be twenty (20) horizontal foot candles and maintained in the following areas:*

(1) *An area of 30 feet wide by 30 feet long immediately behind the paving machines during the operations of the machines.*

(2) *An area 15 feet wide by 30 feet long immediately in front and back of all rolling equipment, during operation of the equipment.*

(3) *An area 15 feet wide by 15 feet long at any point where an area is being tack coated prior to the placement of pavement.*

c. *As partial fulfillment of the above requirements, the Contractor shall furnish and use, complete artificial lighting units with a minimum capacity of 3,000 watt electric beam lights, affixed to all equipment in such a way to direct illumination on the area under construction.*

d. *In addition, the Contractor shall furnish four portable floodlight units similar or equal to the equipment-mounted lights.*

The initial placement and compaction of the mixture shall occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 250 degrees F (121 degrees C).

Edges of existing bituminous pavement abutting the new work shall be saw cut and carefully removed as shown on the drawings and painted with bituminous tack coat before new material is placed against it.

Upon arrival, the mixture shall be placed to the full width by a bituminous paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet except where edge lanes require less width to complete the area. Additional screed sections shall not be attached to widen paver to meet the minimum lane width requirements specified above unless additional auger sections are added to match. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course.

Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools. Areas of segregation in the surface course, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of 2 inches deep. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

If the Contractor places any out of specification mix in the project work area, he will be required to remove it at his own expense, to the satisfaction of the Engineer. If the Contractor has to continue placing non-payment bituminous concrete, as directed by the Engineer, to make the surfaces safe for aircraft operations, the Contractor shall do so to the satisfaction of the Engineer. It is the Contractor's responsibility to leave the facilities

to be paved in a safe condition ready for aircraft operations. No consideration for extended closure time of the area being paved will be given. As a first order of work for the next paving shift, the Contractor shall remove all out of specification material and replace with approved material to the satisfaction of the Engineer. When the above situations occur, there will be no consideration given for additional construction time or payment for extra costs.

401-4.11 COMPACTION OF MIXTURE. *After placing, the mixture shall be thoroughly and uniformly compacted by power rollers. The surface shall be compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.*

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained.

To prevent adhesion of the mixture to the roller, the wheels shall be equipped with a scraper and kept properly moistened but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power driven tampers. Tampers shall weigh not less than 275 pounds, have a tamping plate width not less than 15 inches, be rated at not less than 4,200 vibrations per minute, and be suitably equipped with a standard tamping plate wetting device.

Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

401-4.12 JOINTS. *The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.*

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, uncompacted, or otherwise defective, or which have been left exposed for more than 4 hours, or whose surface temperature has cooled to less than 160° F, shall be cut back 6 inches to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be cleaned and dry prior and given

a tack coat of bituminous material prior to placing any fresh mixture against the joint. The cost of this work and tack coat shall be considered incidental to the cost of the bituminous course.

401-4.13 SKID RESISTANT SURFACES/SAW-CUT GROOVING. *If shown on the plans, skid resistant surfaces for asphalt pavements shall be provided by construction of saw-cut grooves. Saw-cut grooves must meet the requirements of Item P-621.*

MATERIAL ACCEPTANCE

401-5.1 ACCEPTANCE SAMPLING AND TESTING. *All acceptance sampling and testing will be performed by technicians from the City of Los Angeles Standards Division. The Contractor shall be responsible for sampling, preparing specimens handling and testing of asphalt materials for his own Quality Control program. Coring for thickness determination, necessary to determine conformance with the requirements specified in this section will be performed by the Contractor at locations designated by the Engineer.*

a. Plant-Produced Material. *Plant-produced material shall be tested for stability, flow, and air voids on a lot basis. Sampling shall be from material deposited into trucks at the plant or from trucks at the job site. Samples shall be taken in accordance with ASTM D 979. A lot will consist of:*

- *one day or shift's production not to exceed 2,000 tons, or*
- *a half day or shift's production where a day's production is expected to consist of between 2,000 and 4,000 tons, or*
- *similar subdivisions for tonnages over 4,000 tons.*

Where more than one plant is simultaneously producing material for the job, the lot sizes shall apply separately for each plant.

(1) Sampling. *Each lot will consist of four equal sublots. Sufficient material for preparation of test specimens for all testing will be sampled by the Engineer on a random basis, in accordance with the procedures contained in ASTM D 3665. One set of laboratory compacted specimens will be prepared for each sublot in accordance with ASTM D 6926, at the number of blows required by paragraph 401-3.2, Table 1. Each set of laboratory compacted specimens will consist of three test portions prepared from the same sample increment.*

The sample of bituminous mixture may be put in a covered metal tin and placed in an oven for not less than 60 minutes nor more than 90 minutes to stabilize to compaction temperature. The compaction temperature of the specimens shall be as specified in the job mix formula.

(2) Testing. *Sample specimens shall be tested for stability and flow in accordance with ASTM D 6927. Air voids will be determined by the Engineer in accordance with ASTM D 3203.*

Prior to testing, the bulk specific gravity of each test specimen shall be measured by the Engineer in accordance with ASTM D 2726 using the procedure for laboratory-prepared thoroughly dry specimens, or ASTM D 1188, whichever is applicable, for use in computing air voids and pavement density.

For air voids determination, the theoretical maximum specific gravity of the mixture shall be measured one time for each sublot in accordance with ASTM D 2041, Type C, D or E container. The value used in the air voids computation for each sublot shall be based on theoretical maximum specific gravity measurement for the sublot.

The stability and flow for each sublot shall be computed by averaging the results of all test specimens representing that sublot.

(3) Acceptance. *Acceptance of plant produced material for stability, flow, and air voids shall be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b.*

b. Field Placed Material. *Material placed in the field shall be tested for mat and joint density on a lot basis.*

(1) Mat Density. *The lot size shall be the same as that indicated in paragraph 401-5.1a and shall be divided into four equal sublots. One core of finished, compacted materials shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. Cores shall not be taken closer than one foot from a transverse or longitudinal joint.*

(2) Joint Density. *The lot size shall be the total length of longitudinal joints constructed by a lot of material as defined in paragraph 401-5.1a. The lot shall be divided into four equal sublots. One core of finished, compacted materials shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. All coring shall be centered on the joint. The minimum core diameter for joint density determination shall be 5 inches.*

(3) Sampling. *Samples shall be neatly cut with a core drill. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge. The minimum diameter of the sample shall be five inches. Samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. The Contractor shall furnish all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Cored pavement shall be cleaned and core holes shall be filled in a manner acceptable to the Engineer and within one day after sampling.*

(4) Testing. *The bulk specific gravity of each cored sample will be measured by the Engineer in accordance with ASTM D 2726 or ASTM D 1188, whichever is applicable. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the average bulk specific gravity of all laboratory prepared specimens for the lot, as determined in*

paragraph 401-5.1a(2). The bulk specific gravity used to determine the joint density at joints formed between different lots shall be the lowest of the bulk specific gravity values from the two different lots.

(5) Acceptance. *Acceptance of field placed material for mat density will be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b(1). Acceptance for joint density will be determined in accordance with the requirements of paragraph 401-5.2b(3).*

c. Partial Lots — Plant-Produced Material. *When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Engineer agree in writing to allow overages or other minor tonnage placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.*

The last batch produced where production is halted will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. In addition, an agreed to minor placement will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. Where three sublots are produced, they shall constitute a lot. Where one or two sublots are produced, they shall be incorporated into the next lot, and the total number of sublots shall be used in the acceptance plan calculation, i.e., n = 5 or n = 6, for example. Partial lots at the end of asphalt production on the project shall be included with the previous lot.

d. Partial Lots — Field Placed Material. *The lot size for field placed material shall correspond to that of the plant material, except that, in no cases, shall less than three (3) cored samples be obtained, i.e., n = 3.*

401-5.2 ACCEPTANCE CRITERIA.

a. General. *Acceptance will be based on the following characteristics of the bituminous mixture and completed pavement as well as the implementation of the Contractor Quality Control Program and test results:*

(1) *Stability*
(2) *Flow*
(3) *Air voids*
(4) *Mat density*
(5) *Joint density*
(6) *Thickness*
(7) *Smoothness*
(8) *Grade*

Mat density and air voids will be evaluated for acceptance in accordance with paragraph 401-5.2b(1). Stability and flow will be evaluated for acceptance in accordance with paragraph 401-5.2b(2). Joint density will be evaluated for acceptance in accordance with paragraph 401-5.2b(3).

Thickness will be evaluated by the Engineer for compliance in accordance with paragraph 401-5.2b(4). Acceptance for smoothness will be based on the criteria contained in paragraph 401-5.2b(5). Acceptance for grade will be based on the criteria contained in paragraph 401-5.2b(6).

The Engineer may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of bituminous mixture which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

b. Acceptance Criteria.

(1) Mat Density and Air Voids. *Acceptance of each lot of plant produced material for mat density and air voids shall be based on the percentage of material within specification limits (PWL). If the PWL of the lot equals or exceeds 90 percent, the lot shall be acceptable. Acceptance and payment shall be determined in accordance with paragraph 401-8.1.*

(2) Stability and Flow. *Acceptance of each lot of plant produced material for stability and flow shall be based on the percentage of material within specification limits (PWL). If the PWL of the lot equals or exceeds 90 percent, the lot shall be acceptable. If the PWL is less than 90 percent, the Contractor shall determine the reason and take corrective action. If the PWL is below 80 percent, the Contractor must stop production until the reason for poor stability and/or flow has been determined and adjustments to the mix are made*

(3) Joint Density. *Acceptance of each lot of plant produced material for joint density shall be based on the percentage of material within specification limits (PWL). If the PWL of the lot is equal to or exceeds 90 percent, the lot shall be considered acceptable. If the PWL is less than 90 percent, the Contractor shall evaluate the reason and act accordingly. If the PWL is less than 80 percent, the Contractor shall cease operations and until the reason for poor compaction has been determined. IF THE PWL IS LESS THAN 71 PERCENT, THE PAY FACTOR FOR THE LOT USED TO COMPLETE THE JOINT SHALL BE REDUCED BY 5 PERCENTAGE POINTS. This lot pay factor reduction shall be incorporated and evaluated in accordance with paragraph 401-8.1.*

(4) Thickness. *Thickness of each lift of surface course shall be evaluated by the Engineer for compliance to the requirements shown on the plans. Measurements of thickness shall be made by the Engineer using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point shall not be more than ¼ inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, shall not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or sublot shall be corrected by the Contractor at his*

expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the Engineer to circumscribe the deficient area.

(5) Smoothness. *The final surface shall be free from roller marks. The finished surfaces of each course of the pavement, except the finished surface of the final course, shall not vary more than ⅜ inch when evaluated with a 16 foot straightedge. The finished surface of the final course of pavement shall not vary more than ¼ inch when evaluated with a 16 foot straightedge. The lot size shall be 2,000 square yards. Smoothness measurements shall be made at 50 foot intervals and as determined by the Engineer. In the longitudinal direction, a smoothness reading shall be made at the center of each paving lane. In the transverse direction, smoothness readings shall be made continuously across the full width of the pavement. However, transverse smoothness readings shall not be made across designed grade changes. At warped transition areas, straightedge position shall be adjusted to measure surface smoothness and not design grade transitions. When more than 15 percent of all measurements within a lot exceed the specified tolerance, the Contractor shall remove the deficient area to the depth of the final course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above.*

(6) Grade. *The finished surface of the pavement shall not vary from the gradeline elevations and cross sections shown on the plans by more than ½ inch. The finished grade of each lot will be determined by running levels at intervals of 50 feet or less longitudinally and all breaks in grade transversely (not to exceed 50 feet) to determine the elevation of the completed pavement. The Contractor shall pay the cost of surveying of the level runs that shall be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the Engineer. The lot size shall be 2,000 square yards. When more than 15 percent of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates ¾ inch or more from planned grade, the Contractor shall remove the deficient area to the depth of the final course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. The surface of the ground pavement shall have a texture consisting of grooves between 0.090 and 0.130 inches wide. The peaks and ridges shall be approximately 1/32 inch higher than the bottom of the grooves. The pavement shall be left in a clean condition. The removal of all of the slurry resulting form the grinding operation shall be continuous The grinding operation should be controlled so the residue from the operation does not flow across other lanes of pavement. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above.*

c. Percentage of Material Within Specification Limits (PWL). *The percentage of material within specification limits (PWL) shall be determined in accordance with procedures specified in Section 110 of the General Provisions. The specification tolerance limits (L) for lower and (U) for upper are contained in Table 5.*

d. Outliers. *All individual tests for mat density and air voids shall be checked for outliers (test criterion) in accordance with ASTM E 178, at a significance level of 5 percent. Outliers shall be discarded, and the PWL shall be determined using the remaining test values.*

Table 5 ACCEPTANCE LIMITS FOR STABILITY, FLOW, AIR VOIDS, AND DENSITY		
Test Property	***Pavements Designed for Aircraft Gross Weights of 60,000 lbs or More or Tire Pressure Greater than 100 psi***	
Number of Blows	***75***	
	Specification Tolerance	
	L	***U***
Stability, minimum pounds	*1,800*	—
Flow, 0.01-inch	*8*	*16*
Air voids total mix (percent)	*2.0*	*5.0*
Mat Density (percent)	*96.3*	—
Joint density (percent)	*93.3*	—

The criteria in Table 5 is based on production processes which have a variability with the following standard deviations:

Surface Course Mat Density (%), 1.30
Base Course Mat Density (%), 1.55
Joint Density (%), 2.1

The Contractor should note that (1) 90 PWL is achieved when consistently producing a surface course with an average mat density of at least 98 percent with 1.30% or less variability, (2) 90 PWL is achieved when consistently producing a base course with an average mat density of at least 97.5 percent with 1.55% or less variability, and (3) 90 PWL is achieved when consistently producing joints with an average joint density of at least 96 percent with 2.1% or less variability.

401-5.3 RESAMPLING PAVEMENT FOR MAT DENSITY.

a. General. *Resampling of a lot of pavement will only be allowed for mat density, and then, only if the Contractor requests same, in writing, within 48 hours after receiving the written test results from the Engineer. A retest will consist of all the sampling and*

testing procedures contained in paragraphs 401-5.1b and 401-5.2b(1). Only one resampling per lot will be permitted.

(1) *A redefined PWL shall be calculated for the resampled lot. The number of tests used to calculate the redefined PWL shall include the initial tests made for that lot plus the retests.*

(2) *The cost for resampling and retesting shall be borne by the Contractor.*

b. Payment for Resampled Lots. *The redefined PWL for a resampled lot shall be used to calculate the payment for that lot in accordance with Table 6.*

c. Outliers. *Check for outliers in accordance with ASTM E 178, at a significance level of 5 percent.*

401-5.4 LEVELING COURSE. *Any course used for truing and leveling shall meet the requirements of paragraph 401-3.2, 401-5.2b(1) for air voids and 401-5.2b(2), but shall not be subject to the density requirements of paragraph 401-5.2b(1) for mat density and 401-5.2b(3). The leveling course shall be compacted with the same effort used to achieve density of the test section. The truing and leveling course shall not exceed a nominal thickness of 1-½ inches. The leveling course is the first variable thickness lift of an overlay placed prior to subsequent courses.*

CONTRACTOR QUALITY CONTROL

401-6.1 GENERAL. *The Contractor shall develop a Quality Control Program in accordance with Section 12 (FAA 100) of the General Provisions. The program shall address all elements that affect the quality of the pavement including, but not limited to:*

- ***a.*** *Mix Design*
- ***b.*** *Aggregate Grading*
- ***c.*** *Quality of Materials*
- ***d.*** *Stockpile Management*
- ***e.*** *Proportioning*
- ***f.*** *Mixing and Transportation*
- ***g.*** *Placing and Finishing*
- ***h.*** *Joints*
- ***i.*** *Compaction*
- ***j.*** *Surface Smoothness*
- ***k.*** *Personnel*
- ***l.*** *Laydown Plan*

The Contractor shall perform quality control sampling, testing, and inspection during all phases of the work and shall perform them at a rate sufficient to ensure that the work conforms to the contract requirements, and at minimum test frequencies required by paragraph 401-6.3 and Section 100 of the General Provisions. As a part of the process for approving the Contractor's plan, the Engineer may require the Contractor's technician to perform testing of samples to demonstrate an acceptable level of performance.

No partial payment will be made for materials that are subject to specific quality control requirements without an approved plan.

401-6.2 TESTING LABORATORY. *The Contractor shall provide a fully equipped asphalt laboratory located at the job site for use by the Contractor for quality control testing. The laboratory shall meet the requirements of paragraph 401-3.5 and 401-4.2a(2) located at the plant or job site. The Contractor shall provide the Engineer with certification stating that all of the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures.*

The effective working area of the laboratory shall be a minimum of 300 square feet with a ceiling height of not less than 7.5 feet. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 70 degrees F plus 5 degrees.

Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The Engineer shall be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control and acceptance activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

401-6.3 QUALITY CONTROL TESTING. *The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved Quality Control Program. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.*

All testing may be witnessed by the Engineer and/or by the City of Los Angeles Standards Division.

a. Asphalt Content. *A minimum of two tests shall be performed per lot in accordance with ASTM D 6307 or ASTM D 2172 for determination of asphalt content. The weight of ash portion of the test, as described in ASTM D 2172, shall be determined as part of the first test performed at the beginning of plant production; and as part of every tenth test performed thereafter, for the duration of plan production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture. The asphalt content for the lot will be determined by averaging the test results.*

The use of the nuclear method for determining asphalt content in accordance with ASTM D 4125 is permitted, provided that it is calibrated for the specific mix being used.

b. Gradation. *Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D 5444 and*

ASTM C 136 (Dry Sieve). When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants, and tested in accordance with ASTM C 136 (dry sieve) using actual batch weights to determine the combined aggregate gradation of the mixture.

c. Moisture Content of Aggregate. *The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.*

d. Moisture Content of Mixture. *The moisture content of the mixture shall be determined once per lot in accordance with ASTM D 1461 or AASHTO T110.*

e. Temperatures. *Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the bitumen in the storage tank, the mixture at the plant, and the mixture at the job site.*

f. In-Place Density Monitoring. *The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D 2950.*

g. Additional Testing. *Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.*

h. Monitoring. *The Engineer reserves the right to monitor any or all of the above testing.*

401-6.4 SAMPLING. *When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.*

401-6.5 CONTROL CHARTS. *The Contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation and asphalt content.*

Control charts shall be posted in a location satisfactory to the Engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Engineer may suspend production or acceptance of the material.

a. Individual Measurements. *Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation and asphalt content. The control charts shall use the job mix formula target values as*

indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

CONTROL CHART LIMITS FOR INDIVIDUAL MEASUREMENTS		
Sieve	**Action Limit**	**Suspension Limit**
3/4 inch	0%	0%
1/2 inch	±6%	±9%
3/8 inch	±6%	±9%
No. 4	±6%	±9%
No. 16	±5%	±7.5%
No. 50	±3%	±4.5%
No. 200	±2%	±3%
Asphalt Content	±0.45%	±0.70%

b. Range. *Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.*

CONTROL CHART LIMITS BASED ON RANGE (Based on n = 2)	
Sieve	Suspension Limit
½ inch (12.5 mm)	11 percent
⅜ inch (9.5 mm)	11 percent
No. 4 (4.75 mm)	11 percent
No. 16 (1.18 mm)	9 percent
No. 50 (0.30 mm)	6 percent
No. 200 (0.075 mm)	3.5 percent
Asphalt Content	0.8 percent

c. Corrective Action. *The Contractor Quality Control Program shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:*

(1) *One point falls outside the Suspension Limit line for individual measurements or range; or*

(2) *Two points in a row fall outside the Action Limit line for individual measurements.*

The aggregate control chart parameters and Suspension and Action Limits contained in the above paragraphs are based on ¾ inch (19.0 mm) maximum size aggregate gradation. When 1-inch (25.0 mm) or 1-¼ inch (31.2 mm) maximum size aggregate greater than ¾" is specified, the Individual Measurements Chart requirements should be amended as follows:

Sieve	***Action Limit***	***Suspension Limit***
1 inch or 1-½ inch	*0%*	*0%*
¾ inch	*6%*	*11%*

401-6.6 QUALITY CONTROL REPORTS. *The Contractor shall maintain records and shall submit reports of quality control activities daily, in accordance with the Contractor Quality Control Program described in General Provisions, Section 12 (FAA 100).*

METHOD OF MEASUREMENT

401-7.1 MEASUREMENT. *See section 36-2.*

BASIS OF PAYMENT

401-8.1 PAYMENT. *See Section 36-3.*

TESTING REQUIREMENTS

ASTM C 29	*Bulk Density ("Unit Weight") and Voids in Aggregate*
ASTM C 88	*Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate*
ASTM C 117	*Materials Finer than 75µm (No.200) Sieve in Mineral Aggregates by Washing*
ASTM C 127	*Specific Gravity and Absorption of Coarse Aggregate*
ASTM C 131	*Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine*

ASTM C 136	*Sieve Analysis of Fine and Coarse Aggregates*
ASTM C 183	*Sampling and the Amount of Testing of Hydraulic Cement*
ASTM C 566	*Total Evaporable Moisture Content of Aggregate by Drying*
ASTM D 75	*Sampling Aggregates*
ASTM D 979	*Sampling Bituminous Paving Mixtures*
ASTM D 995	*Mixing Plants for Hot-Mixed Hot-Laid Bituminous Paving Mixtures*
ASTM D 1073	*Fine Aggregate for Bituminous Paving Mixtures*
ASTM D 1188	*Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens*
ASTM D 1461	*Moisture or Volatile Distillates in Bituminous Paving Mixtures*
ASTM D 2041	*Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures*
ASTM D 2172	*Quantitative Extraction of Bitumen from Bituminous Paving Mixtures*
ASTM D 2419	*Sand Equivalent Value of Soils and Fine Aggregate*
ASTM D 2489	*Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures*
ASTM D 2726	*Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures*
ASTM D 2950	*Density of Bituminous Concrete in Place by Nuclear Method**s***
ASTM D 3203	*Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures*
ASTM D 3665	*Random Sampling of Construction Materials*
ASTM D 3666	*Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*

ASTM D 4125	*Asphalt Content of Bituminous Mixtures by the Nuclear Method*
ASTM D 4318	*Liquid Limit, Plastic Limit, and Plasticity Index of Soils*
ASTM D 4791	*Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate*
ASTM D 4867	*Effect of Moisture on Asphalt Concrete Paving Mixtures*
ASTM D 5444	*Mechanical Size Analysis of Extracted Aggregate*
ASTM D 6926	*Preparation of Bituminous Specimens Using MARSHALL Apparatus*
ASTM D 6927	*MARSHALL Stability and Flow of Bituminous Mixtures*
ASTM E 11	*Wire-Cloth Sieves for Testing Purposes*
ASTM E 178	*Dealing with Outlying Observations*
ASTM E 1274	*Measuring Pavement Roughness Using a Profilograph*
AASHTO T 30	*Mechanical Analysis of Extracted Aggregate*
[AASHTO T 110	*Moisture or Volatile Distillates in Bituminous Paving Mixtures*
The Asphalt Institute's Manual No. 2 (MS-2)	*Mix Design Methods for Asphalt Concrete*

MATERIAL REQUIREMENTS

ASTM D 242	*Mineral Filler for Bituminous Paving Mixtures*
ASTM D 946	*Penetration Graded Asphalt Cement for Use in Pavement Construction*
ASTM D 3381	*Viscosity-Graded Asphalt Cement for Use in Pavement Construction*
ASTM D 4552	*Classifying Hot-Mix Recycling Agents*
AASHTO M320	*Performance Graded Asphalt Binder*

END OF ITEM P-401

34-2 METHOD OF MEASUREMENT

Plant mix bituminous concrete pavement shall be measured by the number of tons of bituminous mixture used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

34-3 BASIS OF PAYMENT

Payment for an accepted lot of bituminous concrete pavement shall be made at the contract unit price per ton for bituminous mixture adjusted according to paragraph 401-8.1a, subject to the limitation that:

The total project payment for plant mix bituminous concrete pavement shall not exceed **[ ]** percent of the product of the contract unit price and the total number of tons (kg) of bituminous mixture used in the accepted work (See Note 2 under Table 6).

The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

*** The Engineer shall specify a value ranging from 100 to the maximum lot pay factor amount. (106 percent for single-sided density or 103 percent when double-sided density is specified.) When the total project payment for Item P-401 pavement exceeds the contract unit price, any AIP or PFC funds used to pay the excess may require an amendment to the AIP grant or PFC application for the project.**

*** ***

a. Basis of Adjusted Payment. The pay factor for each individual lot shall be calculated in accordance with Table 6. A pay factor shall be calculated for both mat density and air voids. The lot pay factor shall be the higher of the two values when calculations for both mat density and air voids are 100 percent or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either mat density or air voids is 100 percent or higher. The lot pay factor shall be the lower of the two values when calculations for both mat density and air voids are less than 100 percent.

TABLE 6. PRICE ADJUSTMENT SCHEDULE [1]

Percentage of Material Within Specification Limits (PWL)	Lot Pay Factor (Percent of Contract Unit Price)
96 – 100	106
90 – 95	PWL + 10
75 – 89	0.5 PWL + 55
55 – 74	1.4PWL – 12
Below 55	Reject [2]

[1] ALTHOUGH IT IS THEORETICALLY POSSIBLE TO ACHIEVE A PAY FACTOR OF 106 PERCENT FOR EACH LOT, ACTUAL PAYMENT ABOVE 100 PERCENT SHALL BE SUBJECT TO THE TOTAL PROJECT PAYMENT LIMITATION SPECIFIED IN PARAGRAPH 401-8.1.

[2] The lot shall be removed and replaced. However, the Engineer may decide to allow the rejected lot to remain. In that case, if the Engineer and Contractor agree in writing that the lot shall not be removed, it shall be paid for at 50 percent of the contract unit price and the total project payment shall be reduced by the amount withheld for the rejected lot.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph 401-8.1. Payment in excess of 100 percent for accepted lots of bituminous concrete pavement shall be used to offset payment for accepted lots of bituminous concrete pavement that achieve a lot pay factor less than 100 percent.

* *

NOTE TO ENGINEER. The Engineer may specify both upper and lower PWL acceptance criteria (two-sided) for density. Use the following pay adjustment schedule when two-sided acceptance criteria for density is specified edit Table 5 to include the Upper tolerance limits and edit paragraph 401-8.1.

TABLE 6. PRICE ADJUSTMENT SCHEDULE [1]

Percentage of Material Within Specification Limits (PWL)	Lot Pay Factor (Percent of Contract Unit Price)
93 – 100	103
90 – 93	PWL + 10
70 – 89	0.125PWL + 88.75
40 – 69	0.75PWL +45
Below 40	Reject [2]

[1] ALTHOUGH IT IS THEORETICALLY POSSIBLE TO ACHIEVE A PAY FACTOR OF 103 PERCENT FOR EACH LOT, ACTUAL PAYMENT ABOVE 100 PERCENT SHALL BE SUBJECT TO THE TOTAL PROJECT PAYMENT LIMITATION SPECIFIED IN PARAGRAPH 401-8.1.

[2] The lot shall be removed and replaced. However, the Engineer may decide to allow the rejected lot to remain. In that case, if the Engineer and Contractor agree in writing that the lot shall not be removed, it shall be paid for at 50 percent of the contract unit price AND THE TOTAL PROJECT PAYMENT LIMITATION SHALL BE REDUCED BY THE AMOUNT WITHHELD FOR THE REJECTED LOT.

* *

b. Payment. Payment shall be made at the contract unit price per ton for Bituminous Surface Course. This price shall be full compensation for furnishing all materials, and for all labor, supervision, equipment tools, and incidentals necessary to complete the item.

No separate payment will be made for: constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Bituminous Base Course, or Bituminous Surface Course for for taxiway, runway or apron shoulders, or for roadway surfacing, will be measured for payment under Section 36 (FAA P-403) of these specifications.

Payment will be made under:

Item 36.1 Bituminous Surface Course P-401 per ton

END OF SECTION 34

SECTION 36 – PLANT-MIX BITUMINOUS PAVEMENTS (FAA P-403)

36-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of plant mix bituminous pavement for base course for runways and taxiways, and for surface course for runway shoulders, taxiway shoulders, apron shoulders, and roadway surfaces, in accordance with Sections 203 and 302 of the Standard Specifications, except as specified otherwise in FAA Specification Item P-403 as included and modified hereafter, and as shown on the Plans.

Unless otherwise specified, the Contractor may elect to provide "Caltrans Asphalt", as specified in Section 36-3, in lieu of P-403 as hereinafter specified.

Bituminous Surface Course for runway or taxiway surfaces shall be constructed under Section 34 Plant Mix Bituminous Pavements (FAA P-401) of these specifications.

ITEM P-403 PLANT MIX BITUMINOUS PAVEMENTS
(Base, Leveling or Surface Course)

DESCRIPTION

403-1.1 *This item shall consist of a* ***[ ]*** *course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.*

** **

Specify base and/or leveling course(s). Surface course may also be specified but only for those pavements designed to accommodate aircraft of gross weights less than or equal to 12,500 poundsor for surface course of shoulders, blast pads, service roads, etc. Item P-401 is to be specified for surface courses for pavements designed to accommodate aircraft gross weights greater than 12,500 pounds.

This specification is to be used as a base or leveling course for pavements designed to accommodate aircraft of gross weights greater than 12,500 pounds. State highway department specifications may be used in lieu of this

specification for access roads, perimeter roads, stabilized base courses under Item P-501, and other pavements not subject to aircraft loading, or for pavements designed for aircraft gross weights of 12,500 pounds (5,670 kg) or less.

Where a state highway department specification is to be used in lieu of this specification, the state specification must have a demonstrated satisfactory performance record under equivalent loadings and exposure. When a density requirement is not specified by a state specification, it is to be modified to incorporate the language found in paragraphs 403-5.1, 403-5.2 and 403-5.3. When state highway specification are approved, include all applicable/approved state specifications in the contract documents.

* *

MATERIALS

403-2.1 AGGREGATE. *Aggregates shall consist of crushed stone, crushed gravel, or crushed slag with or without natural sand or other inert finely divided mineral aggregate. The portion of combined materials retained on the No. 4 sieve is coarse aggregate. The portion of combined materials passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate, and the portion passing the No. 200 sieve is mineral filler.*

a. Coarse Aggregate. *Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances. The percentage of wear shall not be greater than 40 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 10 percent, or the magnesium sulfate soundness loss shall not exceed 13 percent, after five cycles, when tested in accordance with ASTM C 88.*

Aggregate shall contain at least 70 percent by weight of individual pieces having two or more fractured faces and 85 percent by weight having at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be obtained by crushing.

The aggregate shall not contain more than a total of 8 percent, by weight, of flat particles, elongated particles, and flat and elongated particles, when tested in accordance with ASTM D 4791 with a value of 5:1.

b. Fine Aggregate. *Fine aggregate shall consist of clean, sound, durable, angular shaped particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clay, silt, or other objectionable matter and shall contain no clay balls. The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.*

Natural (nonmanufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. The fine aggregate shall not contain more than 15 percent natural sand by weight of total aggregates. If used, the natural sand shall meet the requirements of ASTM D 1073 and shall have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.

The aggregate shall have sand equivalent values of 45 or greater when tested in accordance with ASTM D 2419.

c. Sampling. *ASTM D 75 shall be used in sampling coarse and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler.*

d. Sources of Aggregates*. Sources of aggregates shall be selected well in advance of the time the materials are required in the work. When the aggregates are obtained from a previously approved source, or an existing source producing aggregates that has a satisfactory service record in airport bituminous pavement construction for at least 5 years, samples shall be submitted 21 days prior to start of production. An inspection of the producer's operation will be made by the Engineer. When new sources are to be developed, the Contractor shall indicate the sources and shall submit a plan for operation 30 days in advance of starting production. Samples from test pits, borings, and other excavations shall be submitted at the same time. Approval of the source of aggregate does not relieve the Contractor in any way of the responsibility for delivery at the job site of aggregates that meet the requirements specified herein.*

e. Samples of Aggregates*. Samples of aggregates shall be furnished by the Contractor at the start of production, and at intervals during production of bituminous mixtures. The sampling points and intervals will be designated by the Engineer. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this section. The Contractor shall furnish documentation and samples to the Engineer confirming that the aggregates meet the specification requirements.*

403-2.2 MINERAL FILLER. *If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.*

403-2.3 BITUMINOUS MATERIAL. *Bituminous material shall conform to the following requirements: AASHTO M320 Performance Grade PG 70-10.*

The Contractor shall furnish vendor's certified test reports for each lot of bituminous material shipped to the project. The vendor's certified test report for the bituminous material can be used for acceptance or tested independently by the Engineer.

403-2.4 PRELIMINARY MATERIAL ACCEPTANCE. *Prior to delivery of materials to the job site, the Contractor shall submit certified test reports to the Engineer for the following materials:*

a. Coarse Aggregate.

(1) *Percent of wear.*
(2) *Soundness.*
(3) *Unit weight of slag.*
(4) *Percent fractured faces*

b. Fine Aggregate.

(1) *Liquid limit.*
(2) *Plasticity index.*
(3) *Sand equivalent.*

c. Mineral Filler.

d. Bituminous Material. *Test results for bituminous material shall include temperature/viscosity charts for mixing and compaction temperatures.*

The certification(s) shall show the appropriate ASTM test(s) for each material, the test results, and a statement that the material meets the specification requirement.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

403-2.5 ANTI-STRIPPING AGENT. *Any anti-stripping agent or additive if required shall be heat stable, shall not change the asphalt cement viscosity beyond specifications, shall contain no harmful ingredients, shall be added in*

recommended proportion by approved method, and shall be a material approved by the Department of Transportation of the State in which the project is located.

COMPOSITION

403-3.1 COMPOSITION OF MIXTURE. *The bituminous plant mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and bituminous material. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).*

403-3.2 JOB MIX FORMULA. *No bituminous mixture for payment shall be produced until a job mix formula has been approved in writing by the Engineer. The bituminous mixture shall be designed using procedures contained in Chapter 5, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No. 2 (MS-2), Mix Design Methods for Asphalt Concrete, sixth edition, and shall meet the requirements of Tables 1, 2 and 3.*

Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867, shall not be less than 75. Anti-stripping agent shall be added to the asphalt, as necessary, to produce a TSR of not less than 75. If an antistrip agent is required, it will be provided by the Contractor at no additional cost to the Owner.

The job mix formula shall be submitted in writing by the Contractor to the Engineer at least 15 days prior to the start of paving operations and shall include as a minimum:

a. *Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percent by weight of each stockpile used in the job mix formula.*

b. *Percent of asphalt cement.*

c. *Asphalt performance, viscosity or penetration grade, and type of modifier if used.*

d. *Number of blows of hammer compaction per side of molded specimen.*

e. *Mixing temperature.*

f. *Compaction temperature.*

g. *Temperature of mix when discharged from the mixer.*

h. *Temperature-viscosity relationship of the asphalt cement.*

i. *Plot of the combined gradation on the Federal Highway Administration (FHWA) 45 power gradation curve.*

j. *Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content.*

k. *Percent natural sand.*

l. *Percent fractured faces.*

m. *Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).*

n. *Tensile Strength Ratio (TSR).*

o. *Antistrip agent (if required).*

The Contractor shall submit to the Engineer the results of verification testing of three (3) asphalt samples prepared at the optimum asphalt content. The average of the results of this testing shall indicate conformance with the job mix formula requirements specified in Tables 1, 2 and 3.

When the project requires asphalt mixtures of differing aggregate gradations, a separate job mix formula and the results of job mix formula verification testing must be submitted for each mix.

The job mix formula for each mixture shall be in effect until a modification is approved in writing by the Engineer. Should a change in sources of materials be made, a new job mix formula must be submitted within 10 days and approved by the Engineer in writing before the new material is used. After the initial production job mix formula(s) has/have been approved by the Engineer and a new or modified job mix formula is required for whatever reason, the subsequent cost of the Engineer's approval of the new or modified job mix formula will be borne by the Contractor. There will be no time extension given or considerations for extra costs associated with the stoppage of production paving or restart of production paving due to the time needed for the Engineer to approve the initial, new or modified job mix formula.

TABLE 1. ***MARSHALL DESIGN CRITERIA***	
TEST PROPERTY	
Number of blows	*75*
Stability, pounds minimum	*2,150*
Flow, 0.01 in.	*10-14*
Air voids (percent)	*2.8 – 4.2*
Percent voids in mineral aggregate, minimum	*See Table 2*

TABLE 2 *MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE*	
Maximum Particle Size	*Minimum Voids in Mineral Aggregate*
in.	*Percent*
1/2	*14*
3/4	*13*
1	*12*
1-1/4	*11*

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM C 136 and C 117.

The gradations in Table 3 represent the limits that shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in the JMF), shall have a gradation within the limits designated in Table 3 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine.

Table 3 *AGGREGATE – BITUMINOUS PAVEMENTS – SURFACE COURSE*			
Sieve Size	***Percentage by Weight Passing Sieves***		
	1-1/4 inch Max	***1 inch Max***	***¾ inch Max***
1-1/4 in.	*100*	*-*	*-*
1 in.	*86—98*	*100*	*-*
¾ in.	*68—93*	*76-98*	*100*
½ in.	*57—81*	*66-86*	*79-99*
3/8 in.	*49—69*	*57-77*	*68-88*
No. 4	*34—54*	*40-60*	*48-68*
No. 8	*22—42*	*26-46*	*33-53*
No. 16	*13—33*	*17-37*	*20-40*
No. 30	*8—24*	*11-27*	*14-30*
No. 50	*6—18*	*7-19*	*9-21*
No. 100	*4—12*	*6-16*	*6-16*
No. 200	*3—6*	*3-6*	*3-6*
Asphalt percent	*4.5—7.0*	*4.5-7.0*	*5.0-7.5*

Deviations from the final approved mix design for bitumen content and gradation of aggregates shall be within the action limits for individual measurements as specified in paragraph 403-6.5a. The limits still will apply if they fall outside the master grading band in Table 3.

The maximum size aggregate used shall not be more than one-half of the thickness of the course being constructed except where otherwise shown on the plans or ordered by the Engineer.

403-3.3 RECYCLED ASPHALT CONCRETE. *If approved for use on the project, recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed*

into the plant, the maximum RAP chunk size shall not exceed 2 inches. The recycled HMA mix shall be designed using procedures contained in AI MS-02. The recycled asphalt concrete mix shall be designed using procedures contained in the Asphalt Institute's Manual Series Number 2 (MS-2). The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D 2172 using the appropriate dust correction procedure. The job mix shall meet the requirements of paragraph 403-3.2 RAP should only be used for shoulder surface course mixes and for any intermediate courses. The amount of RAP shall be limited to 30 percent.

In addition to the requirements of paragraph 403-3.2, the job mix formula shall indicate the percent of reclaimed asphalt pavement and the percent and viscosity grade of new asphalt. The Contractor shall submit documentation to the Engineer, indicating that the mixing equipment proposed for use is adequate to mix the percent of RAP shown in the job mix formula and meet all local and national environmental regulations.

The blend of new asphalt cement and the RAP asphalt binder shall meet the requirements in paragraph 403-2.3. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph 403-2.3

403-3.4 TEST SECTION. *Prior to full production, the Contractor shall prepare and place a quantity of bituminous mixture according to the job mix formula. The amount of mixture shall be sufficient to construct a test section 300 feet long and 20 feet wide**,** placed in two lanes, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. A cold joint is an exposed construction joint at least 4 hours old or whose mat has cooled to less than 160°F. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.*

The test section shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 401-5.1 and 401-6.3. the test section shall be divided into equal sublots. as a minimum the test section shall consist of 3 sublots.

The test section shall be considered acceptable if the average mat density of the test section cores is greater than or equal to 98 percent and the average joint density of the test section cores is greater than or equal to 95 percent.

If the initial test section should prove to be unacceptable, the necessary adjustments to the job mix formula, plant operation, placing procedures, and/or

rolling procedures shall be made. A second test section shall then be placed. If the second test section also does not meet specification requirements, both sections shall be removed at the Contractor's expense. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Any additional sections that are not acceptable shall be removed at the Contractor's expense. Full production shall not begin until an acceptable section has been constructed and accepted in writing by the Engineer. Once an acceptable test section has been placed, payment for the initial test section and the section that meets specification requirements shall be made in accordance with paragraph 403-8.1.

Job mix control testing shall be performed by the Contractor at the start of plant production and in conjunction with the calibration of the plant for the job mix formula. If the aggregates produced by the plant do not satisfy the gradation requirements or produce a mix that meets the JMF, it will be necessary to reevaluate and redesign the mix using plant-produced aggregates. Specimens shall be prepared and the optimum bitumen content determined in the same manner as for the original design tests.

Contractor will not be allowed to place the test section until the Contractor Quality Control Program, showing conformance with the requirements of Paragraph 401-6.1, has been approved, in writing, by the Engineer.

403-3.5 TESTING LABORATORY. *The Contractor's laboratory used to develop the job mix formula shall meet the requirements of ASTM D 3666 including the requirement to be accredited by a national authority such as the National Voluntary Laboratory Accreditation Program (NVLAP), the American Association for Laboratory Accreditation (AALA), or AASHTO Accreditation Program (AAP). A certification signed by the manager of the laboratory stating that it meets these requirements shall be submitted to the Engineer prior to the start of construction. The certification shall contain as a minimum:*

a. *Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.*

b. *A listing of equipment to be used in developing the job mix.*

c. *A copy of the laboratory's quality control system.*

d. *Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.*

e. *ASTM D 3666 certification of accreditation by a nationally recognized accreditation program.*

CONSTRUCTION METHODS

403-4.1 WEATHER LIMITATIONS. *The bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the Engineer, if requested; however, all other requirements including compaction shall be met.*

Table 4 *BASE TEMPERATURE LIMITATIONS*	
Mat Thickness	***Deg. F (Deg. C)***
3 in. or greater	*40 (4)*
Greater than 1 in. but less than 3 in.	*45 (7)*
1 in. or less	*50 (10)*

403-4.2 BITUMINOUS MIXING PLANT. *Plants used for the preparation of bituminous mixtures shall conform to the requirements of ASTM D 995 with the following changes:*

a. Requirements for All Plants.

(1) Truck Scales. *The bituminous mixture shall be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy. Scales shall conform to the requirements of the General Provisions.*

In lieu of scales, and as approved by the Engineer, asphalt mixture weights may be determined by the use of an electronic weighing system equipped with an automatic printer that weighs the total paving mixture. Contractor must furnish calibration certification of the weighing system prior to mix production and as often thereafter as requested by the Engineer.

(2) Testing Facilities. *The Contractor shall provide laboratory facilities at the plant for the use of the Engineer's acceptance testing and the Contractor's quality control testing. The Engineer will always have priority in the use of the laboratory. The lab shall have sufficient space and equipment so that both testing representatives (Engineer's and Contractor's) can operate efficiently. The lab shall also meet the requirements of ASTM D 3666.*

The plant testing laboratory shall have a floor space area of not less than 150 square feet, with a ceiling height of not less than 7-½ feet. The laboratory shall

be weather tight, sufficiently heated in cold weather, air-conditioned in hot weather to maintain temperatures for testing purposes of 70 degrees F +/- 5 degrees F. The plant testing laboratory shall be located on the plant site to provide an unobstructed view, from one of its windows, of the trucks being loaded with the plant mix materials.

Laboratory facilities shall be kept clean, and all equipment shall be maintained in proper working condition. The Engineer shall be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

As a minimum, the plant testing laboratory shall have:

- ***(a)*** *Adequate artificial lighting*
- ***(b)*** *Electrical outlets sufficient in number and capacity for operating the required testing equipment and drying samples.*
- ***(c)*** *Fire extinguishers (2), Underwriter's Laboratories approved*
- ***(d)*** *Work benches for testing, minimum 2-½ feet by 10 feet.*
- ***(e)*** *Desk with 2 chairs*
- ***(f)*** *Sanitary facilities convenient to testing laboratory*
- ***(g)*** *Exhaust fan to outside air, minimum 12 inch blade diameter*
- ***(h)*** *A direct telephone line and telephone including a FAX machine operating 24 hours per day, seven days per week*
- ***(i)*** *File cabinet with lock for Engineer*
- ***(j)*** *Sink with running water, attached drain board and drain capable of handling separate material*
- ***(k)*** *Metal stand for holding washing sieves*
- ***(l)*** *Two element hot plate or other comparable heating device, with dial type thermostatic controls for drying aggregates*
- ***(m)*** *Mechanical shaker and appropriate sieves (listed in JMF, Table 3) meeting the requirements of ASTM E-11 for determining the gradation of coarse and fine aggregates in accordance with ASTM C 136*
- ***(n)*** *Marshall testing equipment meeting ASTM D 6926, ASTM D 6927, or ASTM D 5581 as necessary, automatic compaction equipment capable of compacting three specimens at once and other apparatus as specified in ASTM C 127, D 2172, D 2726, and D 2041*
- ***(o)*** *Oven, thermostatically controlled, inside minimum 1 cubic foot*
- ***(p)*** *Two volumetric specific gravity flasks, 500 CC*
- ***(q)*** *Other necessary hand tools required for sampling and testing*

(r) *Library containing contract specifications, latest ASTM volumes 4.01, 4.02,4.03 and 4.09, AASHTO standard specification parts I and II, and Asphalt Institute Publication MS-2.*

(s) *Equipment for Theoretical Specific Gravity testing including a 4,000 cc pycnometer, vacuum pump capable of maintaining 30 ml mercury pressure and a balance, 16-20 kilograms with accuracy of 0.5 grams*

(t) *Extraction equipment, centrifuge and reflux types and ROTOflex equipment*

(u) *A masonry saw with diamond blade for trimming pavement cores and samples*

(v) *Telephone*

Approval of the plant and testing laboratory by the Engineer requires all facilities and equipment to be in good working order during production, sampling and testing. Failure to provide the specified facilities shall be sufficient cause for disapproving bituminous plant operations.

The Owner shall have access to the lab and at the plant whenever Contractor is producing asphalt for the project.

(3) Inspection of Plant. *The Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.*

(4) Storage Bins and Surge Bins. *Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:*

(a) *The bituminous mixture may be stored in surge bins for a period of time not to exceed 3 hours.*

(b) *The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours.*

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the Engineer determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no temporary storage will be allowed.

403-4.3 HAULING EQUIPMENT. *Trucks used for hauling bituminous mixtures shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of an approved asphalt release agent. Petroleum products shall not be*

used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

403-4.4 BITUMINOUS PAVERS. *Bituminous pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of bituminous plant mix material that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.*

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

The controls shall be capable of working in conjunction with any of the following attachments:

a. *Ski-type device of not less than 30 feet (9.14 m) in length.*

b. *Taut stringline (wire) set to grade.*

c. *Short ski or shoe.*

d. *Laser control.*

If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement and/or base course that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and satisfactory equipment shall be provided by the Contractor.

403-4.5 ROLLERS. *Rollers of the vibratory, steel wheel, and pneumatic-tired type shall be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and*

weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

All rollers shall be specifically designed and suitable for compacting hot mix bituminous concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used. Depressions in pavement surfaces caused by rollers shall be repaired by the Contractor at its own expense.

The use of equipment that causes crushing of the aggregate will not be permitted.

a. Nuclear Densometer. *The Contractor shall have on site a nuclear densometer during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall also supply a qualified technician during all paving operations to calibrate the nuclear densometer and obtain accurate density readings for all new bituminous concrete. These densities shall be supplied to the Engineer upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.*

403-4.6 PREPARATION OF BITUMINOUS MATERIAL. *The bituminous material shall be heated in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325 degrees F (160 degrees C), unless otherwise required by the manufacturer.*

403-4.7 PREPARATION OF MINERAL AGGREGATE. *The aggregate for the mixture shall be heated and dried prior to introduction into the mixer. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F (175 degrees C) when the asphalt is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.*

403-4.8 PREPARATION OF BITUMINOUS MIXTURE. *The aggregates and the bituminous material shall be weighed or metered and introduced into the mixer in the amount specified by the job mix formula.*

The combined materials shall be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet

mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95 percent of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all bituminous mixtures upon discharge shall not exceed 0.5 percent.

403-4.9 PREPARATION OF THE UNDERLYING SURFACE. *Immediately before placing the bituminous mixture, the underlying course shall be cleaned of all dust and debris. A prime coat or tack coat shall be applied in accordance with Sections 39 and 40 of these specifications (FAA Items P-602 or P-603, respectively). A tack coat shall be applied in accordance with Section 33 (FAA Item P-603) when paving on existing paved surfaces, including asphalt base course, and between all lifts of multiple lift asphalt paving.*

403-4.10 LAYDOWN PLAN, TRANSPORTING, PLACING, AND FINISHING. *Prior to the placement of the bituminous mixture, the Contractor shall prepare a laydown plan for approval by the Engineer. This is to minimize the number of cold joints in the pavement. The laydown plan shall include the sequence of paving laydown by stations, width of lanes, temporary ramp location(s), and laydown temperature. The laydown plan shall also include estimated time of completion for each portion of the work (i.e. milling, paving, rolling, cooling, etc.). Modifications to the laydown plan shall be approved by the Engineer.*

The bituminous mixture shall be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 403-4.3. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

The Contractor may elect to use a material transfer vehicle to deliver mix to the paver.

Paving during nighttime construction shall require the following:

a. *All paving machines, rollers, distribution trucks and other vehicles required by the Contractor for his operations shall be equipped with artificial illumination sufficient to safely complete the work.*

b. *Minimum illumination level shall be twenty (20) horizontal foot candles and maintained in the following areas:*

(1) *An area of 30 feet wide by 30 feet long immediately behind the paving machines during the operations of the machines.*

(2) *An area 15 feet wide by 30 feet long immediately in front and back of all rolling equipment, during operation of the equipment.*

(3) *An area 15 feet wide by 15 feet long at any point where an area is being tack coated prior to the placement of pavement.*

c. *As partial fulfillment of the above requirements, the Contractor shall furnish and use, complete artificial lighting units with a minimum capacity of 3,000 watt electric beam lights, affixed to all equipment in such a way to direct illumination on the area under construction.*

d. *In addition, the Contractor shall furnish four portable floodlight units similar or equal to the equipment-mounted lights.*

The initial placement and compaction of the mixture shall occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 250ºF (121ºC).

Edges of existing bituminous pavement abutting the new work shall be saw cut and carefully removed as shown on the drawings and painted with bituminous tack coat before new material is placed against it.

Upon arrival, the mixture shall be placed to the full width by a bituminous paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet except where edge lanes require less width to complete the area. Additional screed sections shall not be attached to widen paver to meet the minimum lane width requirements specified above unless additional auger sections are added to match. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course.

Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools. Areas of segregation in the course, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of 2 inches deep. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

If the Contractor places any out of specification mix in the project work area, he will be required to remove it at his own expense, to the satisfaction of the Engineer. If the Contractor has to continue placing non-payment bituminous concrete, as directed by the Engineer, to make the surfaces safe for aircraft operations, the Contractor shall do so to the satisfaction of the Engineer. It is the Contractor's responsibility to leave the facilities to be paved in a safe condition ready for aircraft operations. No consideration for extended closure time of the area being paved will be given. As a first order of work for the next paving shift, the Contractor shall remove all out of specification material and replace with approved material to the satisfaction of the Engineer. When the above situations occur, there will be no consideration given for additional construction time or payment for extra costs.

403-4.11 COMPACTION OF MIXTURE. *After placing, the mixture shall be thoroughly and uniformly compacted by power rollers. The surface shall be compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.*

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained.

To prevent adhesion of the mixture to the roller, the wheels shall be equipped with a scraper and kept properly moistened using a water soluble asphalt release agent approved by the engineer.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power driven tampers. Tampers shall weigh not less than 275 pounds, have a tamping plate width not less than 15 inches, be rated at not less than 4,200 vibrations per minute, and be suitably equipped with a standard tamping plate wetting device.

Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

403-4.12 JOINTS. *The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.*

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, uncompacted, or otherwise defective, or which have been left exposed for more than 4 hours, or whose surface temperature has cooled to less than 160^0 F, shall be cut back 6 inches to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be cleaned and dry and given a tack coat of bituminous material prior to placing any fresh mixture against the joint. The cost of this work and tack coat shall be considered incidental to the cost of the bituminous course.

MATERIAL ACCEPTANCE

403-5.1 ACCEPTANCE SAMPLING AND TESTING. *Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer at no cost to the Contractor. Testing organizations performing these tests shall meet the requirements of ASTM D 3666. All equipment in Contractor furnished laboratories shall be calibrated by the testing organization prior to the start of operations.*

a. Field Placed Material. *Material placed in the field shall be tested for mat and joint density on a lot basis. A lot will consist of:*

- *one day or shift's production not to exceed 2,000 tons, or*
- *a half day or shift's production where a day's production is expected to consist of between 2,000 and 4,000 tons, or*

- *similar subdivisions for tonnages over 4,000 tons.*

Where more than one plant is simultaneously producing material for the job, the lot sizes shall apply separately for each plant.

(1) Mat Density. *The lot shall be divided into four equal sublots. One core of finished, compacted materials shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. Cores shall not be taken closer than one foot from a transverse or longitudinal joint.*

(2) Joint Density. *The lot shall be divided into four equal sublots. One core of finished, compacted materials shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. Edge of cores will be taken within 6 inches of the joint of the same lot material but not directly on the joint.*

(3) Sampling. *Samples shall be neatly cut with a core drill. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge. The minimum diameter of the sample shall be five inches. Samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. The Contractor shall furnish all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Cored pavement shall be cleaned and core holes shall be filled in a manner acceptable to the Engineer and within one day after sampling.*

(4) Testing. *The bulk specific gravity of each cored sample will be measured by the Engineer in accordance with ASTM D 2726 or ASTM D 1188, whichever is applicable. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the average bulk specific gravity of all laboratory prepared specimens for the lot, as determined as follows:*

(a) *Sufficient material for preparation of test specimens for all testing will be sampled by the Engineer on a random basis, in accordance with the procedures contained in ASTM D 3665. One set of laboratory compacted specimens will be prepared for each sublot in accordance with ASTM D 6926, at the number of blows required by paragraph 403-3.2, Table 1. Each set of laboratory compacted specimens will consist of three test portions prepared from the same sample increment. The sample of bituminous mixture may be put in a covered metal tin and placed in an oven for not less than 30 minutes or more than 60 minutes to stabilize to compaction temperature. The compaction temperature of the specimens shall be as specified in the job mix formula.*

(b) *The bulk specific gravity of each test specimen shall be measured by the Engineer in accordance with ASTM D 2726 using the procedure for laboratory-prepared thoroughly dry specimens, or ASTM D 1188, whichever is applicable, for use in computing pavement density.*

(c) *The bulk specific gravity used to determine the joint density at joints formed between different lots shall be the lowest of the bulk specific gravity values from the two different lots.*

(5) Acceptance. *Acceptance of field placed material for mat and joint density will be determined by the Engineer in accordance with the requirements of paragraph 403-5.2b.*

b. Partial Lots — Field Placed Material. *When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Engineer agree in writing to allow overages or other minor tonnage placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.*

The last batch produced where production is halted will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. In addition, an agreed to minor placement will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. Where three sublots are produced, they shall constitute a lot. Where one or two sublots are produced, they shall be incorporated into the next lot, and the total number of sublots shall be used in the acceptance plan calculation, i.e., n = 5 or n = 6, for example. Partial lots at the end of asphalt production on the project shall be included with the previous lot.

403-5.2 ACCEPTANCE CRITERIA.

a. General. *Acceptance will be based on the following characteristics of the bituminous mixture and completed pavement and test results:*

(1) *Mat density*
(2) *Joint density*
(3) *Thickness*
(4) *Smoothness*
(5) *Grade*

Mat density will be evaluated for acceptance in accordance with paragraph 403-5.2b(1). Joint density will be evaluated for acceptance in accordance with paragraph 403-5.2b(2).

Thickness will be evaluated by the Engineer for compliance in accordance with paragraph 403-5.2b(3). Acceptance for smoothness will be based on the criteria contained in paragraph 403-5.2b(4). Acceptance for grade will be based on the criteria contained in paragraph 403-5.2b(5).

The Engineer may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of bituminous mixture which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

b. Acceptance Criteria.

(1) Mat Density. *Acceptance of each lot of plant produced material for mat density shall be based on the average of all of the densities taken from the sublots. If the average mat density of the lot so established equals or exceeds 96 percent, the lot shall be acceptable. If the average mat density of the lot is below 96 percent, the lot shall be removed and replaced at the Contractor's expense.*

(2) Joint Density. *Acceptance of each lot of plant produced material for joint density shall be based on the average of all of the joint densities taken from the sublots. If the average joint density of the lot so established equals or exceeds 94 percent, the lot shall be acceptable. If the average joint density of the lot is less than 94 percent, the Contractor shall stop production and evaluate the method of compacting joints. Production may resume once the reason for poor compaction has been determined and appropriate measures have been taken to ensure proper compaction.*

(3) Thickness. *Thickness of each course shall be evaluated by the Engineer for compliance to the requirements shown on the plans. Measurements of thickness shall be made by the Engineer using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point shall not be more than ¼ inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, shall not be less than the indicated thickness. Where thickness deficiency exceeds the specified tolerances, the lot or sublot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the Engineer to circumscribe the deficient area.*

(4) Smoothness. *The final surface shall be free from roller marks. The finished surfaces of each course of the pavement, except the finished surface of the final surface course, shall not vary more than ⅜ inch when evaluated with a 16 foot straightedge. The finished surface of the final surface course shall not vary more than ¼ inch when evaluated with a 16 foot straightedge. The lot size shall be 2,000 square yards. Smoothness measurements shall be made at 50 foot intervals and as determined by the Engineer. In the longitudinal direction, a smoothness reading shall be made at the center of each paving lane. In the transverse direction, smoothness readings shall be made continuously across the full width of the pavement. However, transverse smoothness readings shall not be made across designed grade changes. At warped transition areas, straightedge position shall be adjusted to measure surface smoothness and not design grade transitions. When more than 15 percent of all measurements within a lot exceed the specified tolerance, the Contractor shall remove the deficient area to the depth of the course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the course in accordance with the limitations noted above.*

(5) Grade. *The finished surface of the pavement shall not vary from the gradeline elevations and cross sections shown on the plans by more than ½ inch. The finished grade of each lot will be determined by running levels at intervals of 50 feet or less longitudinally and all breaks in grade transversely (not to exceed 50 feet) to determine the elevation of the completed pavement. The Contractor shall pay the cost of surveying of the level runs that shall be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the Engineer. The lot size shall be 2,000 square yards. When more than 15 percent of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates ¾ inch or more from planned grade, the Contractor shall remove the deficient area to the depth of the final course of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off providing the course thickness complies with the thickness specified on the plans. High point grinding will be limited to 15 square yards. The surface of the ground pavement shall have a texture consisting of grooves between 0.090 and 0.130 inches wide. The peaks and ridges shall be approximately 1/32 inch higher than the bottom of the grooves. The pavement shall be left in a clean condition. The removal of all of the slurry resulting form the grinding operation shall be continuous. The grinding operation should be controlled so the residue from the operation does not flow across other lanes of pavement. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above.*

c. Density Outliers. *If the tests within a lot include a very large or a very small value that appears to be outside the normal limits of variation, check for an outlier in accordance with ASTM E 178, at a significance level of 5 percent, to determine if this value should be discarded.*

403-5.3 RESAMPLING PAVEMENT FOR MAT DENSITY.

a. General. *Resampling of a lot of pavement will only be allowed for mat density and then, only if the Contractor requests same in writing, within 48 hours after receiving the written test results from the Engineer. A retest will consist of all the sampling and testing procedures contained in paragraphs 403-5.1b(1). Only one resampling per lot will be permitted.*

(1) *A redefined mat density shall be calculated for the resampled lot. The number of tests used to calculate the redefined mat density shall include the initial tests made for that lot plus the retests.*

(2) *The cost for resampling and retesting shall be borne by the Contractor.*

b. Payment for Resampled Lots. *The redefined mat density for a resampled lot shall be used to evaluate the acceptance of that lot in accordance with Paragraph 403-5.2.*

403-5.4 LEVELING COURSE. *Any course used for truing and leveling shall meet the requirements of paragraph 403-3.2, but shall not be subject to the density requirements of paragraph 403-5.1. The leveling course shall be compacted with the same effort used to achieve density of the test section. The truing and leveling course shall not exceed a nominal thickness of 1-½ inches. The leveling course is the first variable thickness lift of an overlay placed prior to subsequent courses.*

CONTRACTOR QUALITY CONTROL

403-6.1 GENERAL. *The Contractor shall perform quality control sampling, testing, and inspection during all phases of the work and shall perform them at a rate sufficient to ensure that the work conforms to the contract requirements, and at minimum test frequencies required by paragraph 403-6.3, including but not limited to:*

a. *Mix Design*
b. *Aggregate Grading*
c. *Quality of Materials*
d. *Stockpile Management*
e. *Proportioning*

f. *Mixing and Transportation*
g. *Placing and Finishing*
h. *Joints*
i. *Compaction*
j. *Surface smoothness*

403-6.2 TESTING LABORATORY. *The Contractor shall provide a fully equipped asphalt laboratory for conducting quality control testing. The laborabory shall meet the requirements of paragraph 403-3.5 and 403-4.2a(2) and shall be located at the plant or job site. The Contractor shall provide the Engineer with certification stating that all of the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures.*

403-6.3 QUALITY CONTROL TESTING. *The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved Quality Control Program. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness.*

a. Asphalt Content. *A minimum of two tests shall be performed per lot in accordance with ASTM D 2172 for determination of asphalt content. The weight of ash portion of the test, as described in ASTM D 2172, shall be determined as part of the first test performed at the beginning of plant production; and as part of every tenth test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture. The asphalt content for the lot will be determined by averaging the test results.*

The use of the nuclear method for determining asphalt content in accordance with ASTM D 4125 is permitted, provided that it is calibrated for the specific mix being used.

b. Gradation. *Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D 5444 and ASTM C 136 (Dry Sieve). When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants, and tested in accordance with ASTM C 136 (dry sieve) using actual batch weights to determine the combined aggregate gradation of the mixture.*

c. Moisture Content of Aggregate. *The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.*

d. Moisture Content of Mixture. *The moisture content of the mixture shall be determined once per lot in accordance with ASTM D 1461 or AASHTO T110.*

e. Temperatures. *Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the bitumen in the storage tank, the mixture at the plant, and the mixture at the job site.*

f. In-Place Density Monitoring. *The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D 2950.*

g. Additional Testing. *Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.*

h. Monitoring. *The Engineer reserves the right to monitor any or all of the above testing.*

403-6.4 SAMPLING. *When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.*

403-6.5 CONTROL CHARTS. *The Contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation and asphalt content.*

Control charts shall be posted in a location satisfactory to the Engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Engineer may suspend production or acceptance of the material.

a. Individual Measurements. *Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation and asphalt content. The control charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:*

CONTROL CHART LIMITS FOR INDIVIDUAL MEASUREMENTS		
Sieve	**Action Limit**	**Suspension Limit**
3/4 inch	0%	0%
1/2 inch	±6%	±9%
3/8 inch	±6%	±9%
No. 4	±6%	±9%
No. 16	±5%	±7.5%
No. 50	±3%	±4.5%
No. 200	±2%	±3%
Asphalt Content	±0.45%	±0.70%

b. Range. *Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.*

CONTROL CHART LIMITS BASED ON RANGE (Based on n = 2)	
Sieve	Suspension Limit
½ inch (12.5 mm)	11 percent
⅜ inch (9.5 mm)	11 percent
No. 4 (4.75 mm)	11 percent
No. 16 (1.18 mm)	9 percent
No. 50 (0.30 mm)	6 percent
No. 200 (0.075 mm)	3.5 percent
Asphalt Content	0.8 percent

c. Corrective Action. *The Contractor Quality Control Program shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:*

(1) One point falls outside the Suspension Limit line for individual measurements or range; or

(2) Two points in a row fall outside the Action Limit line for individual measurements.

The aggregate control chart parameters and Suspension and Action Limits contained in the above paragraphs are based on ¾ inch (19.0 mm) maximum size aggregate gradation. When 1-inch (25.0 mm) or 1-¼ inch (31.2 mm) maximum size aggregate greater than ¾" is specified, the Individual Measurements Chart requirements should be amended as follows:

Sieve	Action Limit	Suspension Limit
1 inch or 1-½ inch	0%	0%
¾ inch	6%	11%

403-6.6 QUALITY CONTROL REPORTS. *The Contractor shall maintain records and shall submit reports of quality control activities daily, in accordance with the Contractor Quality Control Program described in General Provisions, Section 12 (FAA 100).*

METHOD OF MEASUREMENT

403-7.1 MEASUREMENT. *See Section 36-3.*

BASIS OF PAYMENT

403-8.1 PAYMENT. *See Section 36-4.*

TESTING REQUIREMENTS

ASTM C 29	*Bulk Density ("Unit Weight") and Voids in Aggregate*
ASTM C 88	*Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate*

ASTM C 117	*Materials Finer than 75µm (No.200) Sieve in Mineral Aggregates by Washing*
ASTM C 127	*Specific Gravity and Absorption of Coarse Aggregate*
ASTM C 131	*Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine*
ASTM C 136	*Sieve Analysis of Fine and Coarse Aggregates*
ASTM C 183	*Sampling and the Amount of Testing of Hydraulic Cement*
ASTM C 566	*Total Evaporable Moisture Content of Aggregate by Drying*
ASTM D 75	*Sampling Aggregates*
ASTM D 979	*Sampling Bituminous Paving Mixtures*
ASTM D 995	*Mixing Plants for Hot-Mixed Hot-Laid Bituminous Paving Mixtures*
ASTM D 1073	*Fine Aggregate for Bituminous Paving Mixtures*
ASTM D 1074	*Compressive Strength of Bituminous Mixtures*
ASTM D 1188	*Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens*
ASTM D 1461	*Moisture or Volatile Distillates in Bituminous Paving Mixtures*
ASTM D 2041	*Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures*
ASTM D 2172	*Quantitative Extraction of Bitumen from Bituminous Paving Mixtures*
ASTM D 2419	*Sand Equivalent Value of Soils and Fine Aggregate*

ASTM D 2489	*Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures*
ASTM D 2726	*Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures*
ASTM D 2950	*Density of Bituminous Concrete in Place by Nuclear Methods*
ASTM D 3203	*Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures*
ASTM D 3665	*Random Sampling of Construction Materials*
ASTM D 3666	*Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*
ASTM D 4125	*Asphalt Content of Bituminous Mixtures by the Nuclear Method*
ASTM D 4318	*Liquid Limit, Plastic Limit, and Plasticity Index of Soils*
ASTM D 4791	*Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate*
ASTM D 4867	*Effect of Moisture on Asphalt Concrete Paving Mixtures*
ASTM D 5444	*Mechanical Size Analysis of Extracted Aggregate*
ASTM D 5581	*Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6" Diameter Specimen)*
ASTM D 6926	*Preparation of Bituminous Specimens Using MARSHALL Apparatus*
ASTM D 6927	*MARSHALL Stability and Flow of Bituminous Mixtures*
ASTM E 11	*Wire-Cloth Sieves for Testing Purposes*
ASTM E 178	*Dealing with Outlying Observations*
AASHTO T 30	*Mechanical Analysis of Extracted Aggregate*

[AASHTO T 110	*Moisture or Volatile Distillates in Bituminous Paving Mixtures]*
The Asphalt Institute's Manual No. 2 (MS-2)	*Mix Design Methods for Asphalt Concrete*

MATERIAL REQUIREMENTS

ASTM D 242	*Mineral Filler for Bituminous Paving Mixtures*
ASTM D 946	*Penetration Graded Asphalt Cement for Use in Pavement Construction*
ASTM D 3381	*Viscosity-Graded Asphalt Cement for Use in Pavement Construction*
ASTM D 4552	*Classifying Hot-Mix Recycling Agents*
AASHTO MP1	*Performance Graded Binder Designation*

END OF ITEM P-403

36-2 CALTRANS ASPHALT CONCRETE

In lieu of P-403 plant mix bituminous pavements, as specified above, the Contractor may provide asphalt concrete conforming to Section 39 of the Caltrans Standard Specifications, 2006 edition. Mix shall be Type A, ¾' Max Aggregate, Coarse. Binder shall be PG 70-10. All provisions of Section 39 shall apply, except that the compacted mix shall conform to the acceptance criteria in sections of 403-5.1, 403-5.2 and 403-5.3, herein.

36-3 METHOD OF MEASUREMENT

Plant mix bituminous concrete pavement shall be measured by the number of tons of bituminous mixture, of the type listed in the bid schedule, used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage

36-4 BASIS OF PAYMENT

Payment for an accepted lot of bituminous concrete pavement shall be made at the contract unit price per ton for bituminous mixture of the type indicated in the bid schedule**.** The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item 36.1	Bituminous [Surface] [Base] [Binder] [Leveling] Course P-403	per ton
Item 36.2	Caltrans Asphalt.....	per ton

END OF SECTION 36

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. [Surface][Base] [Leveling] Course
   a) mixture of mineral aggregate and bituminous material
   b) mixed in central plant
   c) to depth, typical section and elevation shown on plans
   d) compacted, finished and approved
2. In accordance with the plans and specifications.
3. Specification also covers asphalt concrete as specified by
   a) the Standard Specifications for Public Works Construction ("Greenbook")
   b) the State of California Department of Transportation ("Caltrans") Standard Specifications
4. Use P-401 – Section 34 for:
   a) Surface course for aircraft > 12,500#
   b) Leveling course for aircraft > 12,500#
   c) Base course for aircraft > 12,500#
5. Use P-403 / Greenbook AC / Caltrans AC - Section 36 - for:
   a) Base Course for all aircraft weight categories
   b) Surface course for:
      (1) Aircraft <12.500#
      (2) Shoulder pavement
      (3) Blast Pads
      (4) Other pavement not subject to aircraft loading including
         (a) Roadways
         (b) Other as specified
6. Type of asphalt concrete required will be shown on the plans or indicated by the Engineer

II. MATERIALS

A. AGGREGATE

1. General
   a) shall be
      (1) crushed stone or
      (2) crushed gravel or
      (3) crushed slag
      (4) with or without
         (a) sand
         (b) other fine mineral aggregate
   b) Definitions:
      (1) Coarse:
         (a) Retained on No. 4 screen
      (2) Fine:
         (a) Passing No. 4 screen
         (b) Retained on No. 200 screen
      (3) Mineral Filler:
         (a) Passing No. 200 screen
2. Coarse Aggregate
   a) sound, tough, durable particles
   b) free from

(1) films
(2) organic matter
(3) other deleterious substances

c) Wear:
(1) ≤ 40% for
(a) Surface Course
(b) Leveling Course
(2) ≤ 50% for Base Course
(3) per ASTM C 131

NOTE TO ENGINEER: HIGHER % WEAR MAY BE ACCEPTABLE WITH RECORD OF SATISFACTORY PERFORMANCE UNDER SIMILAR CONDITIONS OF SERVICE AND EXPOSURE

d) Soundness
(1) Sodium Sulfate Soundness, or
(a) <10%
(2) Magnesium Sulfate Soundness
(a) <13%
(b) after 5 cycles
(3) per ASTM C88

e) Fractured Face Requirement
(1) Definition Fractured face
(a) must be 75% of smallest midsectional area
(b) angles between planes must be > 30 deg to be two faces
(c) must be obtained from crushing
(2) Two fractured faces requirement
(a) ≥ 70%
(3) Single fractured face requirement
(a) ≥ 85%

f) Flat or elongated piece requirement
(1) ≤ 8%
(a) flat
(b) elongated
(c) flat and elongated
(2) per ASTM D 4791 @ 5:1

g) Slag
(1) air-cooled, blast furnace
(2) compacted weight ≥ 70 pcf
(a) per ASTM C 29

3. Fine Aggregate
a) clean, sound, durable, angular particles
b) produced by crushing
(1) stone or
(2) gravel
(a) meeting coarse aggregate requirements for
(i) wear
(ii) soundness
(3) free from coatings
(a) clay
(b) silt
(c) other objectionable materials
c) containing no clay balls

d) Atterberg limits
(1) including added mineral filler:
(a) Plasticity Index (PI) $\leq$ 6
(b) Liquid Limit (LL) $\leq$ 25
(c) per ASTM D 4318
e) natural sand
(1) may be added to obtain gradation
(a) limit 15% by weight of total aggregates
(b) Atterberg limits
(i) Plasticity Index (PI) $\leq$ 6
(ii) Liquid Limit (LL) $\leq$ 25
(iii) per ASTM D 4318
f) Sand Equivalent (SE)
(1) > 45
(2) per ASTM D 2419

4. Sampling
a) per ASTM D 75
(1) for fine aggregate
(2) for coarse aggregate
b) per ASTM C 183
(1) for mineral filler

B. MINERAL FILLER
1. if used shall meet ASTM D 242

C. BITUMINOUS MATERIAL
1. Meet AASHTO M 320 for
a) PG 70-10 – for surface courses
b) PG 64-10 – for base courses
2. provide vendors' certified test reports for each lot of bitumen delivered
a) Engineer may request independent testing

D. PRELIMINARY MATERIAL ACCEPTANCE
1. Prior to delivery to job site, provide certified test reports for:
a) Coarse Aggregate, including:
(1) Percent of wear.
(2) Soundness.
(3) Unit weight of slag.
(4) Percent fractured faces.
b) Fine Aggregate, including:
(1) Liquid limit.
(2) Plasticity index.
(3) Sand equivalent.
c) Mineral Filler
d) Bituminous Material, including:
(1) temperature / viscosity charts for
(a) mixing and compaction temperatures
(2) ASTM test
(3) test results
(4) statement whether material meets requirements
2. Engineer may request samples for testing
a) prior to production
b) during production

E. ANTI-STRIPPING AGENT
1. Any added anti-strip agent shall:

a) be heat stable
b) not change viscosity beyond specified limits
c) contain no harmful ingredients
d) shall be approved by Caltrans

III. COMPOSITION OF MIXTURE

A. GENERAL
1. blend of:
a) well-graded aggregates
(1) maintain in separate size groups
b) filler
c) anti-stripping agent, if required

B. JOB MIX FORMULA
1. Approve mix design prior to any production
2. Use procedures in
a) Chapter 5, MARSHALL METHOD OF MIX DESIGN
(1) Asphalt Institute's (AI) Manual Series No. 2 (MS-2)
(2) Mix Design Methods for Asphalt Concrete, sixth edition.
3. Use design values in Tables 1, 2, and 3:

TABLE 1. MARSHALL DESIGN CRITERIA	
TEST PROPERTY	Criteria
Number of blows	**75**
Stability, pounds minimum	**1800**
Flow, 0.01 in.	**8-16**
Air voids (percent)	**2-5**
Percent voids in mineral aggregate, minimum	**See Table 2**

NOTES TO ENGINEER: MAY USE AI MS-2, CHAPTER 5, PROCEDURES, AND ASTM D 5581 IN LIEU OF ASTM D 6926, IF AGGREGATES OF 1' MAX OF 1.5" MAX USED. MAY NEED TO MODIFY FLOW IF BINDER MODIFIERS ARE USED.

TABLE 2. MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE		
Maximum Particle Size		**Minimum Voids in Mineral Aggregate, percent**
in.	**mm**	**Percent**
½	12.5	14
c¾	19.0	13
1	25.0	12
1-½	37.5	11

NOTES TO ENGINEER: TABLE 2 REFLECTS MODIFICATIONS BASED ON SOUTHERN CALIFORNIA EXPERIENCE

1. Tensile Strength Ratio (TSR)
a) shall be $\geq$ 75
b) per ASTM D 4867
c) add approved anti-stripping agent

(1) if required to raise TSR to $\geq$ 75

2. Job Mix Formula (JMF)
   a) submit at least 15 days prior to production
   b) include values and criteria for:
      (1) Percent passing each sieve size for
         (a) total combined gradation
         (b) individual gradation of all aggregate stockpiles
         (c) percent by weight of each stockpile
      (2) Percent asphalt cement
      (3) Asphalt performance
         (a) penetration grade
         (b) type of modifier, if used
      (4) Number of blows
      (5) Temperatures
         (a) mixing
         (b) compaction
         (c) discharge
      (6) Temperature-viscosity relationship of binder
      (7) FHWA 45-power gradation curve (combined gradation)
      (8) Graphical plots of:
         (a) stability
         (b) flow
         (c) air voids
         (d) voids in the mineral aggregate (VMA)
         (e) unit weight versus asphalt content
      (9) Percent natural sand
      (10) Percent fractured faces
      (11) Percent by weight of:
         (a) flat particles
         (b) elongated particles
         (c) flat and elongated particles
      (12) Tensile Strength Ratio (TSR)
      (13) Antistrip agent (if required)
      (14) Date the job mix formula was developed.
   c) based on at least three samples at optimum asphalt content
      (1) average shall indicate conformance with requirements of Tables 1, 2 and 3.
   d) JMF shall be no older than 90 days
   e) new JMF required
      (1) for each different aggregate gradation / source
      (2) when changes occur to
         (a) sources
         (b) gradations
      (3) regardless of reason for new JMF submittal
         (a) no time extensions will be granted
         (b) Contractor to reimburse for Engineer review/approval
      (4) submit new JMF at least 15 days prior to intended use.
   f) mineral aggregate added shall yield combined gradation conforming to Table 3
      (1) Contractor to select gradation from Table 3 unless otherwise specified
      (2) per ASTM C 136 and C 117
      (3) shall not vary from low limit on one screen to high limit on next, and vice versa

TABLE 3 -AGGREGATE - BITUMINOUS PAVEMENTS				
Sieve Size	**Percentage by Weight Passing Sieves**			
	1-½" max	**1" max**	**¾ " max**	**½" max**
1-½ in.	100	--	--	--
1 in.	86-98	100	--	--
¾ in.	68-93	76-98	100	--
½ in.	57-81	66-86	79-99	100
⅜ in.	49-69	57-77	68-88	79-99
No. 4	34-54	40-60	48-68	58-78
No. 8	22-42	26-46	33-53	39-59
No. 16	13-33	17-37	20-40	26-46
No. 30	8-24	11-27	14-30	19-35
No. 50	6-18	7-19	9-21	12-24
No. 100	4-12	6-16	6-16	7-17
No. 200	3-6	3-6	3-6	3-6
Asphalt percent:				
Stone or gravel	4.5-7.0	4.5-7.0	5.0-7.5	5.5-8.0
Slag	5.0-7.5	5.0-7.5	6.5-9.5	7.0-10.5

(4) apply tolerances VI.E.2 to approved JMF gradation
  (a) may be outside limits of Table 3
(5) maximum aggregate size
  (a) no more than ½ lift thickness
    (i) unless approved by the Engineer
(6) gradation based on uniform specific gravity (SG)
  (a) if SG varies
    (i) correct per AI Manual Series No. 2 (MS-2), Chapter 3

C. [OPTIONAL: RECYCLED ASPHALT CONCRETE
1. Only acceptable for:
  a) shoulders
  b) base course
  c) and only if stated on the plans
2. Shall consist of:
  a) reclaimed asphalt pavement (RAP)
  b) coarse aggregate
  c) fine aggregate
  d) mineral filler
  e) asphalt cement
3. Shall be of consistent
  a) gradation
    (1) chunk size $\leq$ 2 inches
  b) asphalt content
  c) properties
4. design using procedures in AI MS-02
5. determine percentage binder for ASTM D 2171
  a) use appropriate dust correction procedure
6. Job mix shall meet all requirements
  a) in addition include:
    (1) reclaimed asphalt pavement

(2) new asphalt:
(a) percent
(b) viscosity grade

NOTES TO ENGINEER: APPROPRIATE TEST SHOULD BE USED TO DETERMINE NEW ASPHALT GRADE. FOR PG GRADING MIX DESIGN SHOULD INCLUDE DYNAMIC SHEAR REHOMETER TEST AND BENDING BEAM TEST

(3) document that equipment capable of
(a) mixing RAP mix
(b) satisfying local and national environmental regulations

7. Amount of RAP limited to 30% by total weight of aggregate
   a) RAP mix must meet requirements for virgin mixes stated herein
   b) where appropriate, RAP may come from the job site
8. Blend of new asphalt cement and RAP binder:
   a) should meet requirements of II.C
9. New and RAP binder should not be more than two standard grades apart
10. RAP containing coal tars will not be allowed.]

NOTES TO ENGINEER: DELETE PARAGRAPH C IF RECYCLED ASPHALT CONCRETE NOT TO BE ALLOWED ON JOB. ADD SENTENCE THAT RAP WILL NOT BE ALLOWED.

D. TEST SECTION

1. prior to full production place test section per JMF
   a) shall be 300 ft long x 20 ft wide
   b) same depth as project course
   c) placed in two lanes with longitudinal cold joint
      (1) cold joint =
         (a) 4 hrs exposed or
         (b) cooled to < 160 deg F
   d) placed on underlying course conforming to project underlying course
   e) using same type and weight equipment
   f) if night construction required on project, place test section
      (1) under same night lighting proposed
      (2) under same timing restrictions which will be in effect
2. test section to be paid as single lot
   a) divide into minimum 3 equal sublots
   b) acceptance criteria per VI.A and VI.B
3. test section acceptable if :
   a) 90 percent or more within limits for:
      (1) stability
      (2) flow
      (3) mat density
      (4) air voids
      (5) joint density
   b) Following are within the action limits per VII.E, Control Charts:
      (1) gradation
      (2) asphalt content
   c) VMA conforms to Table 2
4. if test section unacceptable
   a) if 1st test section unacceptable:
      (1) make adjustments to:
         (a) JMF

(b) plant operation
(c) placing procedures
(d) rolling

b) if 2nd test section unacceptable
(1) remove both sections at Contractor's expense
(2) construct additional test sections as required

5. no production shall begin until acceptable test section constructed
6. payment for test section
a) per paragraph XI will pay for:
(1) initial test section, and
(2) acceptable test section
7. JMF Control Testing
a) performed by Contractor
(1) at start of production
(2) re: calibration of the plant for the JMF
b) if plant-produced aggregates do not meet gradation
(1) re-evaluate design using plant-produced aggregates
(2) prepare new JMF in same manner as original
8. do not construct test section before Contractor Quality Control Program approved
a) per Section VII.

E. TESTING LABORATORY
1. Lab developing JMF shall:
a) conform to ASTM D 3666
(1) including requirement to be accredited by
(a) NVLAP, or
(b) AALA, or
(c) AAP
b) lab personnel shall meet requirements of Section 12 - Contractor Quality Control Program
c) Provide certification from laboratory manager that requirements are met
(1) prior to start of construction
(2) include, as minimum.
(a) Qualifications of
(i) personnel
(ii) laboratory manager
(iii) supervising technician
(iv) testing technicians.
(b) list of equipment to be used in developing the job mix
(c) copy of the laboratory's quality control system
(d) Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program
(e) ASTM D 3666 certification of accreditation by nationally recognized accreditation program

IV. CONSTRUCTION METHODS

A. WEATHER LIMITATIONS
1. Do not place
a) on wet surface
b) when temperature of underlying course below Table 4:

TABLE 4. BASE TEMPERATURE LIMITATIONS		
Mat Thickness	**Base Temperature (Minimum)**	
	Deg. F	**Deg. C**
3 in. or greater	40	4
Greater than 1 in. but less than 3 in.	45	7
1 in. (2.5 cm) or less	50	10

c) may be waived by the Engineer:
(1) temperature requirements
(2) no other requirements

B. BITUMINOUS MIXING PLANT
1. Requirements for all Plants
a) Truck Scales
(1) approved scales or
(2) certified public scales
(3) inspected and sealed as often as Engineer deems necessary
(4) shall conform to Section 4-1.7
b) In lieu of scales, may use electronic weighing system
(1) equipped with automatic printer
(2) furnish calibration certification
(a) prior to production
(b) as often as requested by Engineer during production
c) Testing Facilities
(1) Contractor to provide
(a) for Contractor's QAQC
(b) for Engineer's acceptance testing
(2) Shall conform to ASTM D 3666
(3) Engineer to have:
(a) priority of use
(b) unrestricted access
(4) Laboratory shall:
(a) have at least 150 sq ft floor space
(b) have ceiling height not less than 7.5 ft
(c) be weather tight
(d) be furnished with climate control
(i) heater
(ii) air conditioner
(iii) to maintain temperature at 70 deg F +/- 5 deg
(e) be located on site with view of trucks being loaded with plant materials
(5) Contractor shall
(a) keep testing facility clean
(b) maintain equipment in working order
(6) Engineer to:
(a) notify in writing of deficiencies in
(i) testing facility
(ii) equipment
(iii) supplies
(iv) personnel
(v) procedures

(b) suspend work if deficiencies serious
(i) not permit operations to resume until corrections made

(7) testing facility shall have:
(a) adequate space and equipment
(i) so both parties can operate efficiently
(b) as a minimum shall have:
(i) Adequate artificial lighting
(ii) Electrical outlets sufficient
(a) in number
(b) capacity
(i) for operating testing equipment
(ii) drying samples.
(iii) Fire extinguishers
(a) at least two (2),
(b) Underwriters Laboratories approved
(iv) Work benches for testing, minimum 2-½ feet by 10 feet.
(v) Desk
(a) with 2 chairs
(vi) Sanitary facilities convenient to testing laboratory
(vii) Exhaust fan to outside air
(a) minimum 12 inch blade diameter
(viii) direct telephone line and telephone
(a) including a FAX machine
(i) operating 24 hours per day
(ii) operating seven days per week
(ix) File cabinet
(a) with lock
(b) for Engineer
(x) Sink with
(a) running water
(b) attached drain board and drain
(c) capable of handling separate material
(xi) Metal stand for holding washing sieves
(xii) Two element hot plate or
(a) other comparable heating device
(b) with dial type thermostatic controls for drying aggregates
(xiii) Mechanical shaker with
(a) appropriate sieves
(i) as listed in JMF, Table 3
(ii) meeting the requirements of ASTM E-11
(iii) for performing ASTM C 136 testing
(xiv) Marshall testing equipment
(a) meeting
(i) ASTM D 6926
(ii) ASTM D 6927
(b) with automatic compaction equipment
(i) capable of compacting three specimens at once
(c) other apparatus as specified in ASTM C 127, D

2172, D 2726, and D 2041

(xv) Oven
- (a) thermostatically controlled
- (b) minimum interior volume 1 cubic foot

(xvi) Two volumetric specific gravity flasks, 500 cc

(xvii) Other necessary hand tools required for sampling and testing

(xviii) Library containing
- (a) contract specifications
- (b) latest ASTM volumes 4.01, 4.02, 4.03 and 4.09
- (c) AASHTO standard specification parts I and II
- (d) Asphalt Institute Publication MS-2

(xix) Equipment for Theoretical Specific Gravity testing including:
- (a) 4,000 cc pycnometer
- (b) vacuum pump capable of maintaining 30 ml mercury pressure
- (c) balance
  - (i) 16-20 kilograms
  - (ii) accuracy of 0.5 grams

(xx) Extraction equipment
- (a) centrifuge type
- (b) reflux type
- (c) ROTOflex equipment

(xxi) masonry saw
- (a) with diamond blades

(8) Plant and laboratory:
- (a) must be in good working order during
  - (i) production
  - (ii) sampling
  - (iii) testing
- (b) if not approved, material produced and tested therein subject to rejection
- (c) Owner to have access to both at all times during production

d) Inspection of Plant

(1) Engineer shall have access at all times relative to:
- (a) adequacy of equipment
- (b) to verify:
  - (i) weights
  - (ii) proportions
  - (iii) material properties
  - (iv) temperatures

e) Storage Bins and Surge Bins

(1) May be used for temporary storage of bituminous mixture
- (a) for not more than 3 hours
- (b) in insulated tanks for not more than 24 hours

(2) mix retrieved from storage must meet all other spec requirements

(3) Engineer will disallow temporary storage if he determines one or more of the following exists:
- (a) excessive heat loss
- (b) segregation
- (c) oxidation

C. HAULING EQUIPMENT
  1. Shall have:
    a) tight, clean, smooth metal beds
      (1) may be lightly coated with
        (a) paraffin oil
        (b) lime solution
        (c) petroleum products not allowed for bed coating
    b) covers
      (1) use during adverse weather
    c) insulated beds required
      (1) if excessive heat loss occurs in transit

D. BITUMINOUS PAVERS
  1. Self-propelled paver
    a) with activated, heated screed
      (1) produce finished surface of required
        (a) evenness
        (b) texture
        (c) without
          (i) tearing
          (ii) shoving
          (iii) gouging
      (2) capable of spreading and finishing
        (a) to specified
          (i) thickness
          (ii) smoothness
          (iii) grade
    b) with sufficient power to propel itself and hauling equipment
      (1) without affecting finished surface
    c) with receiving hopper
      (1) of sufficient capacity to allow continuous, uniform spreading operation
      (2) with distribution system to place material
        (a) uniformly
        (b) in front of screed
        (c) without segregation
    d) with control system
      (1) to automatically control grade
      (2) automatically actuated from
        (a) reference line, or
        (b) system of mechanical sensors
          (i) to maintain paver at correct
            (a) slope: @ +/- 0.1%
            (b) elevation
      (3) able to work with any of the following:
        (a) Ski-type device
          (i) not less than 30 feet in length.
        (b) Taut stringline (wire) set to grade.
        (c) Short ski or shoe.
        (d) Laser control.
  2. discontinue operations and replace spreading/finishing equipment if it leaves
    a) tracks
    b) indented areas

c) other blemishes

E. ROLLERS
1. Type
a) vibratory, or
b) steel wheel, or
c) pneumatic-tired
2. Shall be:
a) of sufficient
(1) weight
(2) number
(3) type
b) in good condition
c) specifically designed for compaction of bituminous mixes
3. Capable of:
a) spreading mix
(1) at slow speed
(2) without displacement
4. Equipment not allowed which:
a) impairs stability of mix
b) crushes aggregate
5. Contractor shall repair at his own cost:
a) depressions caused by equipment

F. NUCLEAR DENSOMETER
1. Contractor shall provide during all paving operations
a) nuclear densometer
b) with qualified technician to
(1) calibrate
(2) obtain accurate density readings
2. Shall be provided to Engineer upon request at any time
3. No separate payment will be made for nuclear densometer

G. PREPARATION OF BITUMINOUS MATERIAL
1. Mix in manner to:
a) avoid local overheating
b) provide continuous supply of mix
c) provide uniform temperature
(1) adequate to provide suitable viscosity for coating of aggregate
(2) not more than 325 deg F
(a) unless otherwise required by manufacturer

H. PREPARATION OF MINERAL AGGREGATE
1. heat and dry prior to introduction into mixer
2. maximum temperature
a) shall not damage aggregate
(1) esp. with high calcium or magnesium content
b) shall not exceed 350 deg F
c) shall not be lower than that required for
(1) complete coating of aggregate
(2) uniform distribution on aggregates
(3) suitable mix workability

I. PREPARATION OF BITUMINOUS MIXTURE
1. Materials introduced by
a) weighing or
b) metering

c) in amounts per JMF

2. Wet mixing time:
   a) Definition:
      (1) For Batch Plant, time=:
         (a) from introduction of bituminous material
         (b) to opening of discharge gate
      (2) For Continuous Plant, time=:
         (a) in transit through drum
   b) until uniform coating is obtained
   c) shortest time to produce satisfactory mix
      (1) established based on % coated particles per ASTM D 2489
         (a) for 95% coated particles
         (b) time function of
            (i) type of plant
            (ii) type of aggregate
      (2) for batch plants
         (a) not less than 25 seconds
      (3) for continuous plants
         (a) divide
            (i) weight of contents at operating level, by
            (ii) weight of mixture delivered per second
   d) moisture content at discharge
      (1) shall not exceed 0.5%

J. PREPARATION OF THE UNDERLYING SURFACE
1. Remove by milling or grinding where specified per Section 21- Surface Preparation:
   a) rubber deposits
   b) paint
2. Clean surface of dust and debris
   immediately before placing bituminous material
3. Apply:
   a) prime coat – per Section 39 – Bituminous Prime Coat, or
   b) tack coat – per Section 40 – Bituminous Tack Coat
   c) as:
      (1) indicated on plans, or
      (2) as directed by Engineer

K. LAYDOWN PLAN, COMPACTION OF MIXTURE, TRANSPORTING, PLACING, AND FINISHING
1. Contractor to provide Laydown Plan prior to paving
   a) purpose – to minimize cold joints
   b) to be approved by the Engineer
      (1) before paving
      (2) subsequent changes made to plan
   c) include:
      (1) sequence by stations
      (2) number of width of lanes
      (3) temporary ramp location(s)
      (4) laydown temperature
      (5) estimated time of completion for each portion
2. Transport of material
   a) in trucks conforming to IV.C
   b) schedule so as to minimize paver
      (1) stopping
      (2) starting

c) do not haul over freshly placed material unless it
   (1) has been compacted
   (2) has been allowed to cool to atmospheric temperature

3. ~~May~~ Shall use transfer vehicle to deliver mix to paver
4. Paving During Nighttime:
   a) all equipment fitted with artificial illumination
      (1) adequate for safe operation
   b) minimum illumination level:
      (1) 20 horizontal foot candles maintained for area:
         (a) 30 feet wide by 30 feet long immediately behind the paving machines
         (b) 15 feet wide by 30 feet long immediately in front and back of all rolling equipment
         (c) 15 feet wide by 15 feet long at any point being prime or tack coated
   c) as partial fulfillment:
      (1) complete light units
         (a) 3,000 watts
         (b) affixed to all equipment
            (i) to illuminate area under construction
   d) in addition provide portable floodlights:
      (1) Number: [INSERT NUMBER]
      (2) Equal to [PROPRIETARY: MANUFACTURER, MODEL], or equal.
   e) Any out of specification material to be removed and replaced at Contractor's expense
      (1) as first order of work next night shift
      (2) no extended closure times will be allowed
      (3) no schedule extensions will be allowed
   f) See Section 11 -Construction Sequencing – for requirements relative to opening night work areas to aircraft traffic after each shift.
5. Initial placement and compaction temperature
   a) suitable for obtaining
      (1) density
      (2) smoothness
      (3) other requirements
   b) not less than 250 deg F
6. When placement abuts existing pavement
   a) sawcut and remove existing pavement
   b) apply bituminous tack coat per Section 40 – Bituminous Tack Coat on all contact surfaces
7. Upon arrival of mix at site
   a) place to full width with approved paver
   b) strike off to uniform thickness such that
      (1) when compacted will provide plan thickness
   c) regulate speed of paver
      (1) to eliminate pulling, tearing
   d) begin placement at
      (1) centerline, for crowned sections
      (2) high edge, for one-way slope
      (3) unless otherwise approved
   e) joint locations
      (1) longitudinal

(a) shall be at centerline for crowned pavement
(b) shall be offset from underlying layer by at least 1 ft.
(2) transverse
(a) shall be offset
(i) from underlying layer by at least 10 ft.
(b) transverse joints in adjacent lanes
(i) offset a minimum of 10 ft
f) place:
(1) in consecutive adjacent lanes
(2) minimum lane width 12.5 ft.
(a) except where edge lanes require less
(b) do not add additional screed sections to provide width
(i) unless auger sections added to match
g) irregular areas
(1) may be spread and luted with hand tools
(2) areas of segregation at the surface shall be removed and replaced at Contractor's expense
(a) remove by sawcutting and milling
(i) minimum depth
(a) 2 inches
(ii) minimum width
(a) paver width
(iii) minimum length
(a) 10 ft

L. COMPACTION OF MIXTURE
1. Compact with power rollers
a) as soon as stable enough to avoid
(1) undue displacement
(2) cracking
(3) shoving
b) sequence and type of roller
(1) at the discretion of the Contractor
c) speed of roller
(1) sufficiently slow to
(a) avoid displacement
(i) correct any displacement at once
(a) from reversing rollers
(b) from any cause
(b) provide effective compaction
2. provide sufficient rollers to
a) handle output of plant
3. continue rolling until
a) uniform texture obtained
b) grade conforms to plans
c) cross-section conforms to plans
d) required field density obtained
4. to prevent adhesion, roller should be
a) equipped with scraper
b) kept sufficiently moistened
(1) excess water not allowed
5. in inaccessible areas
a) compact with approved, power-driven tampers

(1) not less than 275 pounds gross weight
(2) tamping plate not less than 15 inches width
(3) minimum 4,200 vibrations per minute
(4) equipped with
(a) standard tamping plate
(b) plate wetting device

6. defective mixture to be replaced immediately at Contractor's expense
a) loose
b) broken
c) mixed with dirt
d) contains check-cracking
e) any other way defective

M. JOINTS
1. Form all joints to
a) ensure continuous bond between courses
b) obtain required density
c) have same texture as other sections
d) meet requirements for smoothness and grade
2. Transverse joints
a) form by
(1) bulkhead
(2) tapering course
(a) roller over unprotected edge only allowed in this manner
(b) after tapering
(i) cut back to full depth
(ii) on straight line
(iii) apply tack coat to all contact surfaces
3. Longitudinal joints
a) replace if
(1) irregular
(2) damaged
(3) have been
(a) left exposed more than 4 hours, or
(b) surface temperature < 160 deg F
(4) otherwise defective
b) sawcut back to expose clean, sound surface
(1) no more than 6 inches from edge
(2) for full depth of course
c) clean, dry and apply tack to all contact surfaces
d) replacement cost shall be considered incidental

V. MATERIAL ACCEPTANCE

A. ACCEPTANCE SAMPLING AND TESTING
1. General
a) to be performed by the Engineer
(1) at no cost to Contractor
(2) unless otherwise specified
b) testing agencies shall conform to ASTM D 3666
c) all equipment in Contractor-furnished laboratories to be certified by independent testing organization
(1) at start of operations
(2) at Contractor's expense

2. Field-Placed Material
    a) General
        (1) field-placed material tested for mat density and joint density on a lot basis
        (2) on lot basis
            (a) lot =
                (i) one day's shift if < 2,000 tons
                (ii) one-half day's shift if 2,000 to 4,000 tons
                (iii) similar subdivisions if > 4,000 tons/day
            (b) if more than one plant, lots shall apply separately for each plant
    b) Mat Density
        (1) each lot = 4 equal sublots
        (2) one core of finished, compacted material per sublot
        (3) random locations per ASTM D 3665
        (4) locations no closer than one foot from joint
    c) Joint Density
        (1) lot size = total length of longitudinal joint for lot defined in V.A.2.a.2.
        (2) each lot = 4 equal sublots
        (3) one core of finished, compacted material per sublot
        (4) random locations per ASTM D 3665
        (5) edge of cores within 6 inches from, but not on, joint
    d) Sampling
        (1) neatly cut with core drill
            (a) edges of hardened steel with diamond chips embedded
            (b) minimum diameter 5 inches
        (2) clearly defective samples will not be used for testing
        (3) Contractor to provide all tools and labor to
            (a) cut
            (b) clean
            (c) fill
                (i) use material and manner approved by the Engineer
                (ii) fill within one day of sampling
    e) Testing
        (1) determine bulk specific gravity per applicable test method:
            (a) ASTM D 2726, or
            (b) ASTM D 1188
        (2) % compaction (density) of sample =
            (a) bulk specific gravity of each sublot determined as follows:
                (i) sufficient material will be sampled
                    (a) by the Engineer
                    (b) selected on a random basis
                        (i) per ASTM D 3665
                (ii) prepare one specimen per sublot per ASTM D6926
                    (a) use # blows per Table 1
                    (b) eat set of specimens = three test portions from same sample increment
                (iii) place in covered metal tin and placed in oven:
                    (a) for 30 minutes for normal aggregates, to:
                    (b) 60 minutes for absorptive aggregates
                    (c) to stabilize to compaction temperature
                (iv) compaction temperature as specified in JMF
            (b) measure bulk SG per applicable standard
                (i) ASTM D2726, or:

(ii) ASTM D1188

(c) bulk specific gravity of joint samples

(i) use lowest of the values from the two different lots

f) Acceptance

(1) for mat and joint density

(a) per paragraph V.B.2

3. Partial Lots — Field Placed Material

a) Definition Partial Lot:

(1) when operations terminate before specified number of tests made for lot

(2) minor tonnage placements

(a) if agreed in writing Contractor/Engineer

b) Procedure

(1) last batch produced shall be considered representative of sublot, or

(2) minor tonnage placement shall be considered representative of sublot

(3) number of sublots

(a) if three (3) sublots taken

(i) = lot

(b) if one or two sublots taken

(i) shall be incorporated into next lot

(c) adjust "n" value for use in acceptance calculations

c) partial lots at the end of production shall be included in previous lot

B. ACCEPTANCE CRITERIA

1. General

a) Acceptance based on

(1) characteristics of

(a) mix

(b) completed pavement

(2) test results per criteria in VI.B for:

(a) Mat density

(b) Joint density

(c) Thickness

(d) Smoothness

(e) Grade

b) Notwithstanding plant acceptance, Engineer may reject on the basis of

(1) contamination

(2) segregation

(3) incomplete coating of aggregate

(4) improper mix temperature

(5) as based on

(a) visual inspection

(b) temperature measurements

(6) Contractor may take representative sample of rejected material

(a) in the presence of the Engineer

(b) if laboratory tests subsequently demonstrate acceptability

(i) payment will be made at contract unit price

2. Mat Density

a) lot based on average of all densities from sublots

(1) acceptable if $\geq$96%

(2) unacceptable if <96%

(a) remove and replace at Contractor's expense

3. Joint Density

a) lot based on average of all densities from sublots

(1) acceptable if ≥94%
(2) unacceptable if <94%
(a) stop and evaluate method of compacting joint
(b) may resume when appropriate measures taken to correct joint compaction

4. Thickness
a) each lift to be evaluated for thickness
b) one core per sublot, using mat density cores
c) maximum deficiency allowed:
(1) at any point:
(a) not more than ½ inch below plan thickness
(2) average thickness for lift, or combined lifts:
(a) not less than plan thickness
d) if thickness requirements not met, Contractor to repair at his expense
(1) by providing new pavement
(2) may, at his expense, take additional cores to delineate deficient area

5. Smoothness
a) final surface shall be free of roller marks
b) shall not vary more than:
(1) 3/8 inch in 16 ft for base course
(2) 1/4 inch in 16 ft for surface course
c) Lot size = 2,000 square yards
d) measure at 50-ft intervals
(1) longitudinal – measure at center of paving lane
(2) transverse – measure continuously across full width
(3) except across designed grade changes
(a) at transition areas, adjust straightedge to measure smoothness, not grade transitions
e) if more than 15% of measurements out of tolerance
(1) Contractor shall remove and replace
(a) to depth of final course
(2) skin patching not allowed
(3) high spots may be ground off
(a) providing thickness requirements met
(b) grinding areas limited to 15 sq yds
(i) if more than 15 sq yds, remove and replace

6. Grade
a) shall not vary from plan grade by more than ½ inch
b) test:
(1) longitudinally: @ 50-ft intervals
(2) transversely: at all grade breaks
c) Contractor to pay surveying costs
d) provide documentation, stamped and signed by licensed Land Surveyor
e) Lot size = 2,000 sq yds
f) Acceptance
(1) Contractor to remove and replace final course if:
(a) more than 15% outside of tolerance
(b) any one shot > ¾ inch from plan grade
(2) skin patching not allowed
(3) high spots may be ground providing
(a) thickness requirements met
(b) grooved surfaces retain grooves

(i) width: .090 and 0.130 inches
(ii) depth: 1/32 inch
(c) slurry from grinding shall be continuously removed
(i) residue cannot flow across other paving lanes
(d) grinding area limited to 15 sq yds
(i) > 15 sq yds requires removal and replacement

C. RESAMPLING PAVEMENT FOR MAT DENSITY
1. General
a) resampling only allowed for mat density
b) Contractor must request in writing within 48 hours after initial test results
c) use same procedures as initial testing
d) only one resampling per lot allowed
e) new redefined mat density shall include initial and new samples
f) Contractor to bear cost of resampling and testing
2. Payment for Resampled Lots
a) payment will be made per V.B.2.

D. [OPTIONAL: LEVELING COURSE
1. Definition: first variable thickness lift placed prior to subsequent courses
2. must meet air voids requirements
3. will not be held to mat density requirements
4. compact with same effort documented for accepted test section
5. shall not exceed 1.5 inches thickness]

VI. CONTRACTOR QUALITY CONTROL

A. GENERAL
1. Develop Quality Control Program (QCP) per Section 12 – Contractor Quality Control Program
2. Ensure that
a) work conforms to contract documents
b) at minimum test frequencies per VI.C.
3. Program shall address:
a) Mix Design
b) Aggregate Grading
c) Quality of Materials
d) Stockpile Management
e) Proportioning
f) Mixing and Transportation
g) Placing and Finishing
h) Joints
i) Compaction
j) Surface Smoothness

B. TESTING LABORATORY
1. Contractor to provide on-site asphalt testing laboratory conforming to subsections III.E and IV. B.1.c.
2. provide certification that lab equipment
a) is properly calibrated
b) will meet specifications applicable to specified test procedures

C. QUALITY CONTROL TESTING
1. Contractor shall perform all tests per approved QCP
2. Include tests for, not necessarily limited to, tests for:
a) control of asphalt content
b) aggregate gradation

c) temperatures
d) aggregate moisture
e) field compaction
f) surface smoothness

3. Develop Quality Control Testing Plan as part of QCP
4. Asphalt Content
   a) For determination of asphalt content
      (1) two tests per lot, minimum
      (2) per ASTM D 6307 or ASTM D 2172
   b) determine weight of ash portion
      (1) as part of first test
      (2) as part of every 10th test thereafter for duration of production
   c) last ash weight obtained shall be used in asphalt content calculations
   d) asphalt content used for lot will be average of test results
   e) May use nuclear gauge per Section 20 – Nuclear Gauges
      (1) in accordance with ASTM D 4125
      (2) if calibrated for specific mix being used
5. Gradation
   a) test twice per lot, minimum
   b) per ASTM D 544 and ASTM C 136
   c) if asphalt content determined by nuclear gauge, determine gradation:
      (1) based on hot bin samples at batch plant, or
      (2) cold feed from drum plant
      (3) test in accordance with ASTM C 136, dry sieve
6. Moisture Content of Aggregate
   a) test once per lot, minimum
   b) per ASTM C 566
7. Moisture Content of Mixture
   a) test once per lot, minimum
   b) per ASTM D 1461 or AASHTO T 110
8. Temperature
   a) check 4 times per lot, minimum
   b) test mix at locations to determine temperature of:
      (1) dryer
      (2) bitumen in storage tank
      (3) mixture at plant
      (4) mixture at job site.
9. In-Place Density Monitoring
   a) test as frequently as necessary to ensure that required density is being achieved
   b) may monitor with nuclear gauge per Section 20 – Nuclear Gauges
      (1) per ASTM D 2950
10. Additional Testing
   a) perform all other tests Contractor deems necessary to control process
11. Monitoring
   a) Engineer reserves right to monitor all Contractor QC testing

D. SAMPLING
   1. Contractor shall sample and test any material which the Engineer believes to be inconsistent
   2. Sampling and testing per standard procedures described herein

E. CONTROL CHARTS
   1. Contractor shall maintain linear control charts for
      a) individual measurements

b) range (difference highest to lowest)
c) post in location satisfactory to the Engineer
d) include as a minimum:
    (1) project number
    (2) contract item number
    (3) test number
    (4) test parameter
    (5) applicable Action and Suspension Limits
    (6) Contractor's test results
e) use control charts to
    (1) identify potential problems
    (2) assign causes
    (3) before they occur
f) if data indicates problem not be acted upon by Contractor, Engineer may
    (1) suspend production
    (2) reject material

2. Individual Measurements
    a) use for control of
        (1) aggregate gradation
        (2) asphalt content
        (3) use JMF target values of central tendencies, for following:

TABLE 5
CONTROL CHART LIMITS FOR INDIVIDUAL MEASUREMENTS

Sieve	Action Limit	Suspension Limit
¾ inch	0%	0%
½ inch	+/-6%	+/-9%
⅜ inch	+/-6%	+/-9%
No. 4	+/-6%	+/-9%
No. 16	+/-5%	+/-7.5%
No. 50	+/-3%	+/-4.5%
No. 200	+/-2%	+/-3%
Asphalt Content	+/-0.45%	+/-0.70%

3. Range
    a) use to control
        (1) process variability for parameters noted in table, below
    b) range for each lot = difference two test results for each control parameter
    c) Suspension Limits in table based on n=2
        (1) if more tests performed, adjust suspension limits by multiplying Suspension Limit by:
            (a) 1.18 for n = 3
            (b) 1.27 for n = 4

TABLE 6
CONTROL CHART LIMITS BASED ON RANGE (Based on n = 2)

Sieve	Suspension Limit
½ inch	11 percent
⅜ inch	11 percent

No. 4	11 percent
No. 16	9 percent
No. 50	6 percent
No. 200	3.5 percent
Asphalt Content	0.8 percent

4. Corrective Action
   a) QCP shall indicate appropriate action to be taken if process out of tolerance:
      (1) set of rules to gauge process
      (2) actions to be taken
   b) Process will be considered out of control and production will be stopped if:
      (1) One point outside individual measurement Suspension Limit line
      (2) Two points outside individual measurement Action Limit line.

NOTES TO ENGINEER: Charts based on ¾-inch max aggregate. if 1' or 1.5" max aggregate used, amend Individual Measurement chart as follows:

1 inch or 1-½ inch	0%	0%
¾ inch	6%	11%

If 1' or 1.5" max aggregate used, amend Individual Measurement chart as follows:

1) delete 1-inch and ¾ inch Action and Suspension Limits
2) revise 1/2 –inch limits to:

½-inch	0%	0%

3) delete ½-inch sieve from Range Chart

F. QUALITY CONTROL REPORTS
   1. Submit QC reports to Engineer daily, per Section 12 – Contractor Quality Control Program

VII. GREENBOOK ASPHALT CONCRETE

A. GENERAL
   1. For locations identified on the plans, provide asphalt concrete conforming to:
   2. "Brown Book"
      a) August 03, 2009 Version
      b) City of Los Angeles Department of Public Works
      c) includes additions and amendments to:
         (1) 2006 Edition
         (2) 2008 Cumulative Supplement to the Standard Specifications for Public Work Construction, (SSPWC).

B. MATERIALS
   1. Asphalt Concrete shall conform to the following Sections, including referenced sections and subsections, of the Brown Book for the types of mixes specified:
      a) 203-1 Paving Asphalt
      b) 203-6 Asphalt Concrete
      c) 203-7 Recycled Asphalt Concrete – Hot Mixed
      d) 203-10 Latex Modified Asphalt Concrete
   2. Asphalt for this project shall be:

a) C2-PG70-10, or
b) C2-PG64-10, or
c) [OPTIONAL: STATE OTHER TYPE]

3. [OPTIONAL IF RECYCLED ASPHALT CONCRETE ALLOWED:
a) C2-PG-70-10-RAP 15%, or
b) C2-PG-64-10-RAP 15%]

C. CONSTRUCTION METHODS
1. Construction shall be in accordance with Section 302-5 of the SSPWC.
2. Tack coat, as specified in 302-5.4, shall be required between lifts and on all contact surfaces
3. Prime coat, as specified in 302-5.3, shall be required on all unbound underlying surfaces

VIII. CALTRANS ASPHALT CONCRETE

A. GENERAL
1. For locations identified on the plans, provide asphalt concrete conforming to:
2. Standard Specifications, State of California Department of Transportation (Caltrans)
a) May 2006 version of the
b) Sections 39-1 through 39-7

B. MATERIALS
1. Asphalt Concrete shall conform to Section 39-2, including referenced sections and subsections, of the Caltrans specifications for the types of mixes specified.
a) Type A: ¾-inch Max Coarse
b) Type B: ¾-inch Max Medium
c) Leveling Course: ½-inch Max Medium
d) If not otherwise specified, mix shall be Type A
e) except that
(1) the maximum aggregate size shall not be more than ½ the thickness of the compacted finished pavement
(2) If planned layer < 1/5 inches:
(a) for Type A substitute ½-inch Max Coarse
(b) for Type B substitute ½-inch Max Medium
2. Asphalt Binder shall be type PG64-10 unless otherwise specified

C. CONSTRUCTION METHODS
1. Conform to requirements of Sections 39-3 through 39-7.

IX. SUBMITTAL REQUIREMENTS

A. JOB MIX FORMULA
1. Aggregates
2. Bitumen
a) grade certifications

B. LABORATORY CERTIFICATIONS
C. TESTING FACILITY CERTIFICATIONS
D. SCALE CERTIFICATIONS

X. METHOD OF MEASUREMENT

A. PLANT MIX BITUMINOUS PAVEMENT – P-403 – SURFACE COURSE
1. per ton
2. Measured by recorded batch weights or truck scale weights

B. PLANT MIX BITUMINOUS PAVEMENT – P-403 – BASE COURSE
1. per ton
2. Measured by recorded batch weights or truck scale weights

C. PLANT MIX BITUMINOUS PAVEMENT – P-403 – LEVELING COURSE
1. per ton
2. Measured by recorded batch weights or truck scale weights]

D. GREENBOOK ASPHALT [TYPE]
   1. per ton
   2. Measured by recorded batch weights or truck scale weights
E. CALTRANS ASPHALT [TYPE]
   1. per ton
   2. Measured by recorded batch weights or truck scale weights

XI. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
   1. 36.1 Plant- Mix Bituminous Pavement P-403 – Surface Course – per ton
   2. 36.2 Plant- Mix Bituminous Pavement P-403 – Base Course – per ton
   3. 36.3 Plant- Mix Bituminous Pavement P-403 – Leveling Course – per ton
   4. 36.4 Greenbook Asphalt Concrete Type [ ] – per ton
   5. 36.5 Caltrans Asphalt Concrete Type [ ] - per ton
   6. Is full compensation for all preparation, mixing, placing, compaction, labor, equipment, tools, incidentals
   7. No separate payment for work in areas of night or limited-time construction area.

XII. TESTING REQUIREMENTS

A.	ASTM C 29	BULK DENSITY (“UNIT WEIGHT”) AND VOIDS IN AGGREGATE
B.	ASTM C 88	SOUNDNESS OF AGGREGATES BY USE OF SODIUM SULFATE OR MAGNESIUM SULFATE
C.	ASTM C 117	MATERIALS FINER THAN 75MM (NO.200) SIEVE IN MINERAL AGGREGATES BY WASHING
D.	ASTM C 127	SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE
E.	ASTM C 131	RESISTANCE TO DEGRADATION OF SMALL SIZE COARSE AGGREGATE BY ABRASION AND IMPACT IN THE LOS ANGELES MACHINE
F.	ASTM C 136	SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
G.	ASTM C 183	SAMPLING AND THE AMOUNT OF TESTING OF HYDRAULIC CEMENT
H.	ASTM C 566	TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING
I.	ASTM D 75	SAMPLING AGGREGATES
J.	ASTM D 979	SAMPLING BITUMINOUS PAVING MIXTURES
K.	ASTM D 995	MIXING PLANTS FOR HOT-MIXED HOT-LAID BITUMINOUS PAVING MIXTURES
L.	ASTM D 1073	FINE AGGREGATE FOR BITUMINOUS PAVING MIXTURES
M.	ASTM D 1074	COMPRESSIVE STRENGTH OF BITUMINOUS MIXTURES
N.	ASTM D 1188	BULK SPECIFIC GRAVITY AND DENSITY OF COMPACTED BITUMINOUS MIXTURES USING PARAFFIN-COATED SPECIMENS
O.	ASTM D 1461	MOISTURE OR VOLATILE DISTILLATES IN BITUMINOUS PAVING MIXTURES

P.	ASTM D 2041	THEORETICAL MAXIMUM SPECIFIC GRAVITY AND DENSITY OF BITUMINOUS PAVING MIXTURES
Q.	ASTM D 2172	QUANTITATIVE EXTRACTION OF BITUMEN FROM BITUMINOUS PAVING MIXTURES
R.	ASTM D 2419	SAND EQUIVALENT VALUE OF SOILS AND FINE AGGREGATE
S.	ASTM D 2489	ESTIMATING DEGREE OF PARTICLE COATING OF BITUMINOUS-AGGREGATE MIXTURES
T.	ASTM D 2726	BULK SPECIFIC GRAVITY AND DENSITY OF NON-ABSORPTIVE COMPACTED BITUMINOUS MIXTURES
U.	ASTM D 2950	DENSITY OF BITUMINOUS CONCRETE IN PLACE BY NUCLEAR METHODS
V.	ASTM D 3203	PERCENT AIR VOIDS IN COMPACTED DENSE AND OPEN BITUMINOUS PAVING MIXTURES
W.	ASTM D 3665	RANDOM SAMPLING OF CONSTRUCTION MATERIALS
X.	ASTM D 3666	MINIMUM REQUIREMENTS FOR AGENCIES TESTING AND INSPECTING ROAD AND PAVING MATERIALS
Y.	ASTM D 4125	ASPHALT CONTENT OF BITUMINOUS MIXTURES BY THE NUCLEAR METHOD
Z.	ASTM D 4318	LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS
AA.	ASTM D 4791	FLAT PARTICLES, ELONGATED PARTICLES, OR FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE
BB.	ASTM D 4867	EFFECT OF MOISTURE ON ASPHALT CONCRETE PAVING MIXTURES
CC.	ASTM D 5444	MECHANICAL SIZE ANALYSIS OF EXTRACTED AGGREGATE
DD.	ASTM D 5581	RESISTANCE TO PLASTIC FLOW OF BITUMINOUS MIXTURES USING MARSHALL APPARATUS (6" DIAMETER SPECIMEN)
EE.	ASTM D 6926	PREPARATION OF BITUMINOUS SPECIMENS USING MARSHALL APPARATUS
FF.	ASTM D 6927	MARSHALL STABILITY AND FLOW OF BITUMINOUS MIXTURES
GG.	ASTM E 11	WIRE-CLOTH SIEVES FOR TESTING PURPOSES
HH.	ASTM E 178	DEALING WITH OUTLYING OBSERVATIONS
II.	AASHTO T 30	MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE
JJ.	[AASHTO T 110	MOISTURE OR VOLATILE DISTILLATES IN BITUMINOUS PAVING MIXTURES]
KK.	THE ASPHALT INSTITUTE'S	MIX DESIGN METHODS FOR ASPHALT CONCRETE

MANUAL NO. 2 (MS-2)

XIII. MATERIAL REQUIREMENTS

A.	ASTM D 242	MINERAL FILLER FOR BITUMINOUS PAVING MIXTURES
B.	ASTM D 946	PENETRATION GRADED ASPHALT CEMENT FOR USE IN PAVEMENT CONSTRUCTION
C.	ASTM D 3381	VISCOSITY-GRADED ASPHALT CEMENT FOR USE IN PAVEMENT CONSTRUCTION
D.	ASTM D 4552	CLASSIFYING HOT-MIX RECYCLING AGENTS
E.	AASHTO MP1	PERFORMANCE GRADED BINDER DESIGNATION

XIV. END OF SECTION

SECTION 37 – PORTLAND CEMENT CONCRETE PAVEMENT (FAA P-501)

37-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of jointed plain and reinforced Portland Cement Concrete Pavement for runways, taxiways or aprons, in accordance with Sections 201 and 303 of the Standard Specifications, except as specified otherwise in FAA Specification Item P-501, as included and modified hereafter, and as shown on the Plans.

This item also includes constructing temporary load-bearing surfacing, in the form of temporary panels, steel plating, or other methods, which will provide acceptable levels of support and safety for aircraft traffic between nightly work periods. Such surfacing must satisfy FAA Runway and/or Taxiway Safety Area requirements for smoothness, durability and strength.

ITEM P-501 PORTLAND CEMENT CONCRETE PAVEMENT

DESCRIPTION

501-1.1 *This work shall consist of pavement composed of jointed Portland cement concrete, with reinforcement and without reinforcement, constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross sections shown on the plans.*

MATERIALS

501-2.1 AGGREGATES.

a. Reactivity. *Aggregates shall be tested for deleterious reactivity with alkalis in the cement, which may cause excessive expansion of the concrete. Tests of coarse and fine aggregate shall be made in accordance with ASTM C 1260. If the expansion of the coarse or fine aggregate test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 16 days from casting, the coarse or fine aggregates shall be accepted.*

If the expansion at 16 days is greater than 0.10%, tests of combined materials shall be made in accordance with ASTM C 1260 or ASTM C 1567 using the aggregates, cementitious materials, and/or specific reactivity reducing chemicals in the proportions proposed for the mixture design. If the expansion of the proposed combined materials test specimens, tested in accordance with ASTM C 1260 or ASTM C 1567, does not exceed 0.10 % at 30 days from casting, the proposed combined materials will be accepted. If the expansion of the proposed

combined materials test specimens is greater than 0.10% at 30 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10 % at 30 days, or new aggregates shall be evaluated and tested.

b. Fine Aggregate. *Fine aggregate shall conform to the requirements of ASTM C 33. Gradation shall meet the requirements of Table 1 when tested in accordance with ASTM C 136, except as may otherwise be qualified under Section 6 of ASTM C 33.*

TABLE 1. GRADATION FOR FINE AGGREGATE (ASTM C 33)	
Sieve Designation (Square Openings)	*Percentage by Weight Passing Sieves*
3/8 in. (9.5 mm)	*100*
No. 4 (4.75 mm)	*95-100*
No. 8 (2.36 mm)	*80-100*
No. 16 (1.18 mm)	*50-85*
No. 30 (600 micro-m)	*25-60*
No. 50 (300 micro-m)	*10-30*
No. 100 (150 micro-m)	*2-10*

c. Coarse Aggregate. *Coarse aggregate shall conform to the requirements of ASTM C 33. Gradation, within the separated size groups, shall meet the requirements of Table 2 when tested in accordance with ASTM C 136. When the nominal maximum size of the aggregate is greater than 1 inch, the aggregates shall be furnished in two size groups.*

Aggregates delivered to the mixer shall consist of crushed stone, crushed or uncrushed gravel, air-cooled blast furnace slag, crushed recycled concrete pavement, or a combination thereof. The aggregate shall be composed of clean, hard, uncoated particles and shall meet the requirements for deleterious substances contained in ASTM C 33, Class 4M. Dust and other coating shall be removed from the aggregates by washing. The aggregate in any size group shall not contain more than 8 percent by weight of flat or elongated pieces when tested in accordance with ASTM D 4791. A flat or elongated particle is one having a ratio between the maximum and the minimum dimensions of a circumscribing rectangular prism exceeding 5 to 1.

The percentage of wear shall be no more than 40 when tested in accordance with ASTM C 131 or ASTM C 535.

Table 2 *GRADATION FOR COARSE AGGREGATE* *ASTM C 33*	
Sieve Designations (square openings)	***Percentage by Weight Passing Sieves***
in.	*
1-1/2	*100*
1	*95—100*
1/2	*25—60*
No. 4	*0—10*
No. 8	*0—5*

d. Aggregate susceptibility to Disintegration (D) Cracking. *Aggregates that have a history of D-cracking shall not be used. Prior to approval of mixture design and production of Portland cement concrete the Contractor shall submit written certification that the aggregate does not have a history of D-Cracking and that the aggregate meets the specified State requirements.*

(1) *Other sources of crushed stone aggregate shall be approved if the durability factor as determined by ASTM C 666 is greater than or equal to 95 and all other quality test requirements within these specifications are fulfilled. The FAA will consider and reserves final approval of other State classification procedures.*

(2) *Crushed gravel and sand-gravel aggregates shall not be required to meet freeze-thaw durability ratings. These aggregates shall be approved for use in concrete by the state highway agency in the state from which the aggregate originates and the state in which they are to be used and shall meet all other criteria within these specifications.*

e. Aggregate Source*. Fine aggregate shall be from Hanson Quarry, Irwindale, CA, and coarse aggregate shall be from Hanson Quarry, Eagle Valley, CA, unless otherwise approved by the Engineer.*

501-2.2 CEMENT. *Cement shall conform to the requirements of ASTM C-150 Type II or V.*

If for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

Only cements containing less than 0.6% equivalent alkali or cements that can demonstrate a positive reduction in the expansion created by alkali-silica reactions shall be used. Cement delivered to the job site shall be tested and shall contain not more than 0.05% alkali than that used in the ASTM C 1260 reactivity testing described in Section 501- Testing shall be done on the initial delivery, and not less than once every 2 weeks of production. When eight consecutive tests show acceptable results, test frequency may be increased to once every 4 week, with the Engineer's approval.

501-2.3 CEMENTITIOUS MATERIALS.

a. Fly Ash or Natural Pozzolan. *Fly ash shall meet the requirements of ASTM C 618, Class F with the exception of loss of ignition, where the maximum shall be less than 6 percent for Class F or N. The supplementary optional chemical and physical properties of Table 3 contained in ASTM C 618 shall apply. Fly ash such as is produced in furnace operations utilizing liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish vendor's certified test reports for each shipment of Fly Ash used in the project. The vendor's certified test report can be used for acceptance or the material may be tested independently by the Engineer.*

b. Blast Furnace Slag (Slag Cement). *Ground Granulated Blast Furnace (GGBF) slag shall conform to ASTM C 989, Grade 100 or 120. GGBF shall be used only at a rate between 25 and 55 percent of the total cementitious material by mass.*

501-2.4 PREMOLDED JOINT FILLER. *Premolded joint filler for expansion joints shall conform to the requirements of ASTM D 1751 or D 1752, Type II or III and shall be punched to admit the dowels where called for on the plans. Joint filler must be compatible with joint sealants. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the Engineer. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the Engineer.*

501-2.5 JOINT SEALER. *The joint sealer for the joints in the concrete pavement shall meet the requirements of Item P-605 and shall be of the type(s) specified in the plans.*

501-2.6 STEEL REINFORCEMENT. *Reinforcing shall consist of Welded deformed steel fabric conforming to the requirements of ASTM A 497.*

501-2.7 DOWEL AND TIE BARS. *Tie bars shall be deformed steel bars and conform to the requirements of ASTM A 615 or ASTM A 996, except that rail steel bars, Grade 50 or 60, shall not be used for tie bars that are to be bent or restraightened during construction. Tie bars designated as Grade 40 in ASTM A 615 can be used for construction requiring bent bars.*

Dowel bars shall be plain steel bars conforming to ASTM A 615 or ASTM A 966 and shall be free from burring or other deformation restricting slippage in the concrete. High strength dowel bars shall conform to ASTM A 714, Class 2, Type S, Grade I, II or III, Bare Finish. Before delivery to the construction site each dowel bar shall be painted with one coat of paint conforming to MIL-DTL-24441/20A.SSPC Paint 5 or SSPC Paint 25.Metal or plastic collars shall be full circular device supporting the dowel until the epoxy hardens.

The sleeves for dowel bars used in expansion joints shall be metal or other type of an approved design to cover 2 to 3 inches of the dowel, with a closed end and with a suitable stop to hold the end of the bar at least 1 inch from the closed end of the sleeve. Sleeves shall be of such design that they will not collapse during construction.

501-2.8 WATER. *Water used in mixing or curing shall be clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product. Water will be tested in accordance with the requirements of AASHTO T 26. Water known to be of potable quality may be used without testing.*

501-2.9 COVER MATERIAL FOR CURING. *Curing materials shall conform to one of the following specifications:*

a. *Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C 309, Type 2, Class B, or Class A if wax base only. The proposed curing compound shall satisfy the following requirements:*

(1) Shall maintain relative humidity of concrete surface above 80% for 7 days;

(2) Shall contain white pigment;

(3) Shall be uniform and easily maintained in a thoroughly mixed solution;

(4) Shall form a tough film to withstand early construction traffic.

b. *White polyethylene film for curing concrete shall conform to the requirements of ASTM C 171.*

c. *White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C 171.*

d. *Waterproof paper for curing concrete shall conform to the requirements of ASTM C 171.*

501-2.10 ADMIXTURES. *The use of any material added to the concrete mix shall be approved by the Engineer. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.*

a. Air-Entraining Admixtures. *Air-entraining admixtures shall meet the requirements of ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.*

b. Chemical Admixtures. *Water-reducing, set retarding, and set-accelerating admixtures shall meet the requirements of ASTM C 494, including the flexural strength test. High-Range Water Reducing admixtures will not be allowed except for high-early strength concrete mixes.*

501-2.11 EPOXY-RESIN. *Epoxy-resin used to anchor dowels and tie bars in pavements shall conform to the requirements of ASTM C 881, Type I, Grade 3, Class C. Class A or B shall be used when the surface temperature of the hardened concrete is below 60 degrees F (16 degrees C).*

501-2.12 MATERIAL ACCEPTANCE. *Prior to use of materials, the Contractor shall submit certified test reports to the Engineer for those materials proposed for use during construction. The certification shall show the appropriate ASTM test(s) for each material, the test results, and a statement that the material passed or failed.*

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

MIX DESIGN

501-3.1.1 PROPORTIONS. *Concrete shall be designed to achieve a 28-day flexural strength that meets or exceeds the acceptance criteria contained in paragraph 501-5.2 for a flexural strength of 650 psi, unless otherwise indicated on the plans. The mix shall be designed using the procedures contained in Chapter 9 of the Portland Cement Association's manual, "Design and Control of Concrete Mixtures".*

A separate mix design is required for each flexural strength, and for each type of placement (slipform, side-form, hand placed, etc.), required by the construction sequencing.

The Contractor shall note that to ensure that the concrete actually produced will meet or exceed the acceptance criteria for the specified strength, the mix design average strength must be higher than the specified strength. The amount of overdesign necessary to meet specification requirements depends on the producer's standard deviation of flexural test results and the accuracy that that value can be estimated from historic data for the same or similar materials.

The minimum cementitious material (cement plus fly ash, or GGBFS) shall be 600 pounds per cubic yard. The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall not be more than 0.45 by weight.

Prior to the start of paving operations and after approval of all material to be used in the concrete, the Contractor shall submit a mix design showing the proportions and flexural strength obtained from the concrete at 7 and 28 days. The mix design shall include copies of test reports, including test dates, and a complete list of materials including type, brand, source, and amount of cement, fly ash, ground slag, coarse aggregate, fine aggregate, water, and admixtures. The fineness modulus of the fine aggregate and the air content shall also be shown. The mix design shall be submitted to the Engineer at least 15 days prior to the start of operations. The submitted mix design shall not be more than 90 days old. Production shall not begin until the mix design is approved in writing by the Engineer.

Should a change in sources be made, or admixtures added or deleted from the mix, a new mix design must be submitted to the Engineer for approval.

Flexural strength test specimens shall be prepared in accordance with ASTM C 192 and tested in accordance with ASTM C 78. The mix determined shall be workable concrete having a slump in accordance with the following for various methods of placement: 1) slip form construction: ½ inch to 1½ inches; 2) side

form construction: 1 inch to 3 inches; and 3) hand work: 2 inches to 4 inches. Slump requirements will be waived for high-early strength concrete.

501-3.1.2 Combined Aggregate Grading. *The Job Mix Design shall be developed using the procedures contained in Chapter 9 of the Portland Cement Association's manual, "Design and Control of Concrete Mixtures." (see Paragraph 501-3.3.1, this Specification). However, the combined gradation of the aggregates proposed by the mix design effort shall be analyzed to ensure conformance with the Percentage Aggregate Retained Graph, and with the Coarseness Factor/Workability Factor, as outlined below. Proposed mix designs may be rejected for failure to satisfy these combined aggregate gradation requirements even although all other aspects of the mix design may be within specified limits.*

a. Aggregate Grading Controls. *The coarse aggregate, blending sizes (when required), and fine aggregate shall be combined to be graded from the coarse to the fine. Reports of grading shall include sieve sizes 1½", 1", 3/4" ½" 3/8", No.4, No. 8, No. 16, No. 30, No. 50, and No. 100.*

b. Percent Aggregate Retained Graph. *The combined grading shall be plotted on a standard soils gradation graph as the percentage retained for each reporting sieve size versus the considered sieve size. The Y-axis is the percent retained. The X-axis is the sieve size. The plot of the graph should be a smooth curve showing a transition between coarse and fine aggregate. The plot shall not have a significant valley or peak between the 3/8 inch size and the finest reporting sieve size. Information on the grading requirement, and examples of the presentation, is given in US Air Force publication, "Proportioning Concrete Mixtures with Graded Aggregates, A Handbook for Rigid Airfield Pavements".*

This document is available for download at:

http://www.wbdg.org/ccb/AF/AFETL/etl_97_5.pdf

c. Coarseness Factor/Workability Factor. *The combined gradation shall be used to calculate a coarseness factor and a workability factor. The coarseness factor is defined as the percent of combined aggregate retained above the No. 8 sieve which is also retained above the 3/8" sieve. It is calculated by dividing the percent of material retained above the 3/8" sieve by the percent retained above the No. 8 sieve, times 100:*

$$\text{Coarseness Factor} = (100) \times \frac{\text{(\% retained above 3/8 sieve)}}{\text{(\% retained above \#8 sieve)}}$$

The workability factor is defined as the percentage of combined aggregate finer than the No. 8 sieve. The workability factor is increased linearly at a rate of 2.5

units for each 72.5 pounds per cubic yard of cementitious material above or below a baseline cementitious materials content of 564 pounds per cubic yard. If the total cementitious material is 564 pounds per cubic yard, there is no adjustment.

The factors, defined above, shall be plotted on a chart similar to Figure 1, below. The coarseness factor shall not be greater than 75 nor less than 45. The plot of the workability factor and the coarseness factor shall be a single point above the control line and within the workability box defined by the Control lines. The aggregate grading shall be selected to allow for a variance in the stockpile grading based on historical test results from the aggregate source. The Engineer may reject a job mix submittal should he determine that, although the proposed combined aggregate gradation meets the specification requirements, the overlay of historical variability may result in non-conforming gradation during the duration of the project.

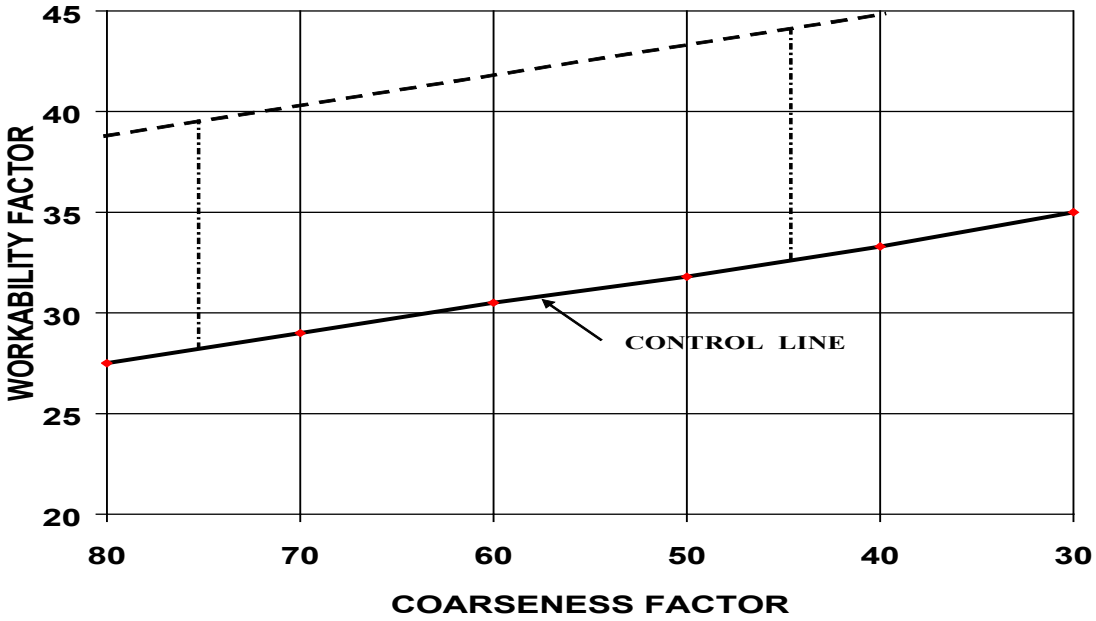

Figure 1 - Aggregate Proportioning Guide

d. Mix Design Format. *The proportioning study shall be provided in report format and will include a graph of the flexural strength versus time (in days) for the selected mixture proportions. Concrete specimens for concrete specified at 28-day strength shall be tested at the ages of 7, 14, and 28 days, minimum. Concrete specimens for concrete specified as high early-strength shall*

be tested hourly as required to determine strength adequacy for the opening to traffic time stipulated on the plans.

501-3.2 CEMENTITIOUS MATERIALS.

a. Fly Ash. *Fly ash may be used in the mix design. When fly ash is used as a partial replacement for cement, the minimum cement content may be met by considering Portland cement plus fly ash as the total cementitious material. The replacement rate shall be determined from laboratory trial mixes, but shall be between 20 and 30 percent by weight of the total cementitious material. If fly ash is used in conjunction with ground granular blast furnace slag the maximum replacement rate shall not exceed 10 percent by weight of total cementitious material.*

b. Ground Slag. *Ground blast-furnace slag may be used in a mix design containing Type I or Type II cement. The slag, or slag plus fly ash if both are used, may constitute between 25 to 55 percent of the total cementitious material by weight. If the concrete is to be used for slipforming operations and the air temperature is expected to be lower than 55 degrees F (13 degrees C) the percent slag shall not exceed 30 percent by weight.*

501-3.3 ADMIXTURES.

a. Air-Entraining. *Air-entraining admixture shall be added in such a manner that will insure uniform distribution of the agent throughout the batch. The air content of freshly mix air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air in the mix shall be 3%. Air content shall be determined by testing in accordance with ASTM C 231 for gravel and stone coarse aggregate and ASTM C 173 for slag and other highly porous coarse aggregate.*

b. Chemical. *Water-reducing, set-controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted on trial mixes, with the materials to be used in the work, in accordance with ASTM C 494. Use of high range water reducers will not be allowed for mixes specified by 28-day strength, but may be used for high early-strength mixes.*

501-3.4 TESTING LABORATORY. *The laboratory used to develop the mix design shall meet the requirements of ASTM C 1077. The laboratory accreditation will include ASTM C 78. A certification that it meets these requirements shall be submitted to the Engineer prior to the start of mix design.*

The certification shall include evidence that the laboratory is inspected/accredited for the test methods required herein by a nationally recognized laboratory inspection accreditation organization.

501-3.5 PAVEMENT CONSTRUCTION TEST SECTION. *The Contractor shall construct an 80 feet x 600 feet test section ("test strip") using the materials, equipment and methods he intends to use for the main production for the project. The Test Section shall be constructed at the location, and to the dimensions, lines and grades shown on the plans. It includes joints at the locations, and of the types, shown on the plans. Installation of centerline light cans and conduit will also be required. Grooving of selected slabs of the test section will also be done as part of the approval process, however grooving will not be required until such time as the Contractor is ready to mobilize for grooving of production pavement. At that time, selected slabs of the test section will be grooved, and acceptable performance noted as the standard against which the acceptability of grooving will be judged.*

For high early-strength mixes, the Test Section shall be constructed at the location, and to the dimensions, lines and grades determined by the Engineer. The test section shall be no less than two full slabs in size, using the approved high early-strength concrete mix. The high early-strength pavement shall be placed using the same time duration as will be allowed during actual construction. As part of the high early-strength test section the Contractor shall also place the temporary load bearing surfacing he proposes to use in high early-strength nighttime construction areas.

The intent of the test section is to allow the Contractor to demonstrate that concrete satisfying all project requirements can be batched, mixed, hauled and placed within the specified conditions. The Contractor is expected to adjust the mix, adjust equipment, and modify procedures such that by the end of the test

The Contractor shall obtain written approval of the test section, from the Engineer, before proceeding with the work. If the section, or any part of the test section, is rejected, the cause shall be documented and reasons for rejection provided. The test section approval/rejection will be issued by the Engineer at the end of the day on which the test section is placed. The work will not proceed until the Contractor can demonstrate the placement and finish of an acceptable test section.

Concrete placed within a test section that is not accepted shall be removed and replaced, at the sole expense of the Contractor.

Prior to the use of any placement method other than that used for the approved Test Section, a separate test section will be required for each method of placement (slipform, side-form, hand-placement). Location and size of the test section shall be as directed by the Engineer.

The quality of all aspects of the accepted test section shall be used throughout the project as the standard of quality against which pavement will be judged for acceptability.

CONSTRUCTION METHODS

501-4.1 EQUIPMENT. *Equipment necessary for handling materials and performing all parts of the work shall be approved by the engineer as to design, capacity, and mechanical conditions. The equipment shall be at the jobsite sufficiently ahead of the start of paving operations to be examined thoroughly and approved.*

a. Batch Plant and Equipment. *The batch plant and equipment shall conform to the requirements of ASTM C 94.*

b. Mixers and Transportation Equipment.

(1) General. *Concrete may be mixed at a central plant, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.*

(2) Central plant mixer. *Central plant mixers shall conform to the requirements of ASTM C 94.*

The mixer shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

(1) Batching Plant Controls. The batching controls shall be either semiautomatic or automatic. Separate bins or compartments shall be provided for each size group of aggregate and for each type of cementitious material to be used. If measured by weight, water shall not be weighed cumulatively with another ingredient, and filling and discharging valves shall be interlocked so that the discharge valve cannot be opened before the filling valve is closed. An accurate mechanical device for measuring and dispensing each admixture shall be provided.

(2) Scales. Scales shall be provided for the accurate measurement and control of each of the materials in each batch of concrete. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other

measuring device. Scales shall be accurate to +/- 0.2% of total scale capacity. Scales shall be tested within each quarter.

(3) Moisture Control. The plant shall be capable of adjustment to compensate for moisture content variations within aggregate stockpiles. Plant shall be capable of controlling water addition to an accuracy of +/- 1% of total mixing water.

(3) Truck mixers and truck agitators. *Truck mixers used for mixing and hauling concrete and truck agitators used for hauling central-mixed concrete shall conform to the requirements of ASTM C 94.*

(4) Nonagitator trucks. *Nonagitating hauling equipment shall conform to the requirements of ASTM C 94.*

c. Finishing Equipment. *The standard method of constructing concrete pavements on FAA projects shall be with an approved slip-form paving equipment designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine so a dense and homogeneous pavement is achieved with a minimum of hand finishing. The paver-finisher shall be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements. It shall weigh at least 2200 lbs. per foot of paving lane width and powered by an engine having at least 6.0 horsepower per foot of lane width.*

On projects requiring less than 500 square yards of cement concrete pavement or requiring individual placement areas of less than 500 square yards, or irregular areas at locations inaccessible to slip-form paving equipment, cement concrete pavement may be placed with approved placement and finishing equipment utilizing stationary side forms. Hand screeding and float finishing may only be utilized on small irregular areas as allowed by the Engineer.

d. Vibrators. *Vibrator shall be the internal type. Operating frequency for internal vibrators shall be between 8,000 and 12,000 vibrations per minute. Average amplitude for internal vibrators shall be 0.025-0.05 inches.*

The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of ACI 309, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the Engineer.

Hand held vibrators may be used in irregular areas only, but shall meet the recommendations of ACI 309, Guide for Consolidation of Concrete.

e. Concrete Saws. *The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations.*

f. Side Forms. *Straight side forms shall be made of steel and shall be furnished in sections not less than 10 feet in length. Forms shall have a depth equal to the pavement thickness at the edge, and a base width equal to or greater than the depth. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the Engineer. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 1/4 inch. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when approved by the Engineer.*

g. Pavers. *The paver shall be fully energized, self-propelled, and designed for the specific purpose of placing, consolidating, and finishing the concrete pavement, true to grade, tolerances, and cross section. It shall be of sufficient weight and power to construct the maximum specified concrete paving lane width as shown in the plans, at adequate forward speed, without transverse, longitudinal or vertical instability or without displacement. The paver shall be equipped with electronic or hydraulic horizontal and vertical control devices.*

h. Drills. *Drills used for drilling dowel openings in previously placed pavement shall be multiple-bit gang-drills capable of drilling multiple dowel openings. Drills shall have necessary controls to ensure accurate alignment and location of the dowels. The Contractor shall maintain a sufficient inventory of spare parts for drills, and a supply of sharp and true drill bits, on site throughout the duration of the paving to ensure that there is no delay to production. The Engineer retains the right to require that equipment and bits be replaced if quality is deemed unacceptable. Bits shall be capable of providing clean and true holes equal in quality to those produced for the accepted Test Section.*

501-4.2 FORM SETTING. *Forms shall be set sufficiently in advance of the concrete placement to insure continuous paving operation. After the forms have*

been set to correct grade, the underlying surface shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place sufficiently to maintain the form in position for the method of placement.

Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/8 inch at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of concrete.

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete.

501-4.3 CONDITIONING OF UNDERLYING SURFACE. *The compacted underlying surface on which the pavement will be placed shall be widened approximately 3 feet to extend beyond the paving machine track to support the paver without any noticeable displacement. After the underlying surface has been placed and compacted to the required density, the areas that will support the paving machine and the area to be paved shall be trimmed or graded to the plan grade elevation and profile by means of a properly designed machine. The grade of the underlying surface shall be controlled by a positive grade control system using lasers, stringlines, or guide wires. If the density of the underlying surface is disturbed by the trimming operations, it shall be corrected by additional compaction and retested at the option of the Engineer before the concrete is placed except when stabilized subbases are being constructed. If damage occurs on a stabilized subbase, it shall be corrected full depth by the Contractor. If traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately before the placement of concrete. The prepared grade shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete. The underlying surface shall be protected so that it will be entirely free of frost when concrete is placed.*

501-4.4 CONDITIONING OF UNDERLYING SURFACE, SIDE-FORM AND FILL-IN LANE CONSTRUCTION. *The prepared underlying surface shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from the concrete. Damage caused by hauling or usage of other equipment shall be corrected and retested at the option of the Engineers. If damage occurs to a stabilized subbase, it shall be corrected full depth by the Contractor. A template shall be provided and operated on the forms immediately in advance of the placing of all concrete. The template shall be propelled only by hand and not attached to a tractor or other power unit. Templates shall be adjustable so that they may be set and maintained at the correct contour of the underlying surface. The adjustment and operation of*

the templates shall be such as will provide an accurate retest of the grade before placing the concrete thereon. All excess material shall be removed and wasted. Low areas shall be filled and compacted to a condition similar to that of the surrounding grade. The underlying surface shall be protected so that it will be entirely free from frost when the concrete is placed. The use of chemicals to eliminate frost in the underlying surface shall not be permitted.

The template shall be maintained in accurate adjustment, at all times by the Contractor, and shall be checked daily.

501-4.5 HANDLING, MEASURING, AND BATCHING MATERIAL. *The batch plant site, layout, equipment, and provisions for transporting material shall assure a continuous supply of material to the work. Stockpiles shall be constructed in such a manner that prevents segregation and intermixing of deleterious materials.*

Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage.

Batching plants shall be equipped to proportion aggregates and bulk cement, by weight, automatically using interlocked proportioning devices of an approved type. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, such as a chute, boot, or other approved device, to prevent loss of cement. The device shall be arranged to provide positive assurance that the cement content specified is present in each batch.

501-4.6 MIXING CONCRETE. *The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are emptied into the drum. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C 94.*

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or nonagitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in nonagitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. Retempering concrete by adding water or by other means will not be permitted.

With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified in the approved mix design is not exceeded, and approved by the Engineer.

501-4.7 LIMITATIONS ON MIXING AND PLACING. *No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.*

a. Cold Weather. *Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40 degrees F (4 degrees C) and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F (2 degrees C).*

The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50 degrees F (10 degrees C) at the time of placement. Concrete shall not be placed on frozen material nor shall frozen aggregates be used in the concrete.

When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150 degrees F (66 degrees C). The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

b. Hot Weather. *During periods of hot weather when the maximum daily air temperature exceeds 85 degrees F (30 degrees C), the following precautions shall be taken.*

The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90 degrees F (35 degrees C). The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

The finished surfaces of the newly laid pavement shall be kept damp by applying a water-fog or mist with approved spraying equipment until the pavement is covered by the curing medium. If necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess of 0.2 psf per hour as determined in accordance with Figure 2.1.5 in ACI 305R, Hot Weather Concreting, which takes into consideration relative humidity, wind velocity, and air temperature.

When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor shall immediately take such additional measures as necessary to protect the concrete surface. Such measures shall consist of wind screens, more effective fog sprays, and similar measures commencing immediately behind the paver. If these measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

c. Temperature Management Program. *Prior to the start of paving operation for each day of paving, the contractor shall provide the engineer with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. As a minimum the program shall address the following items:*

(1) *Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.*

(2) *Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity.*

(3) *Anticipated timing of initial sawing of joint.*

501-4.8 PLACING CONCRETE. *The Contractor has the option of placing the concrete with either side (fixed) forms or slip-forms. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet. Backhoes and Grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders will not be used unless the contractor demonstrates that they can be used without contaminating the concrete and base course and it is approved by the Engineer.*

Hauling equipment or other mechanical equipment can be permitted on adjoining previously constructed pavement when the concrete strength reaches a flexural strength of 550 psi , or a compressive strength of 3,500 psi, based on the average of four field cured specimens per 2,000 cubic yards of concrete placed. Also, subgrade and subbase planers, concrete pavers, and concrete finishing equipment may be permitted to ride upon the edges of previously constructed pavement when the concrete has attained a minimum flexural strength of 400 psi.

a. Slip-Form Construction. *The concrete shall be distributed uniformly into final position by a self propelled slip-form paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be*

adequate to provide a consistency of concrete that will stand normal to the surface with sharp well defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms.

The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit shall not exceed 9 inches. The spacing of internal units shall be uniform and shall not exceed 18 inches.

The term internal vibration means vibrating units located within the specified thickness of pavement section.

The rate of vibration of each vibrating unit shall be within 8000 to 12000 cycles per minute and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit an for a distance of at least one foot. The frequency of vibration or amplitude shall vary proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible. And all operations of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

b. Side-Form Construction. *Side form sections shall be straight, free from warps, bends, indentations, or other defects. Defective forms shall be removed from the work. Metal side forms shall be used except at end closures and transverse construction joints where straight forms of other suitable material may be used.*

Side forms may be built up by rigidly attaching a section to either top or bottom of forms. If such build-up is attached to the top of metal forms, the build-up shall also be metal.

Width of the base of all forms shall be equal to at least 80 percent of the specified pavement thickness.

Side forms shall be of sufficient rigidity, both in the form and in the interlocking connection with adjoining forms, that springing will not occur under the weight of subgrading and paving equipment or from the pressure of the concrete. The Contractor shall provide sufficient forms so that there will be no delay in placing concrete due to lack of forms.

Before placing side forms, the underlying material shall be at the proper grade. Side forms shall have full bearing upon the foundation throughout their length and width of base and shall be placed to the required grade and alignment of the finished pavement. They shall be firmly supported during the entire operation of placing, compacting, and finishing the pavement.

Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars where these are specified.

Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms. Curing compound shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and oiled each time they are used and before concrete is placed against them.

Concrete shall be spread, screeded, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery.

Concrete for the full paving width shall be effectively consolidated by internal vibrators without causing segregation. Internal type vibrators' rate of vibration shall be not less than 7,000 cycles per minute. Amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete more than one foot from the vibrating element. The Contractor shall furnish a tachometer or other suitable device for measuring and indicating frequency of vibration.

Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 20 seconds in any one location, nor shall the vibrators be used to move the concrete.

The provisions relating to the frequency and amplitude of internal vibration shall be considered the minimum requirements and are intended to ensure adequate density in the hardened concrete.

c. Consolidation Testing. *The provisions relating to the frequency and amplitude of internal vibration shall be considered the minimum requirements and are intended to ensure adequate density in the hardened concrete. If a lack of consolidation of the concrete is suspected by the Engineer, additional referee testing may be required. Referee testing of hardened concrete will be performed by cutting cores from the finished pavement after a minimum of 24 hours curing. Density determinations will be made based on the water content of the core as taken. ASTM C 642 shall be used for the determination of core density in the saturated-surface dry condition. Referee cores will be taken at the minimum rate of one for each 500 cubic yards of pavement, or fraction thereof.*

The average density of the cores shall be at least 97 percent of the original mix design density, with no cores having a density of less than 96 percent of the original mix design density.

Failure to meet the above requirements will be considered as evidence that the minimum requirements for vibration are inadequate for the job conditions, and additional vibrating units or other means of increasing the effect of vibration shall be employed so that the density of the hardened concrete as indicated by further referee testing shall conform to the above listed requirements.

501-4.9 STRIKE-OFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT. *Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screeded. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When*

reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

501-4.10 JOINTS. *Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2 inch from their designated position and shall be true to line with not more than 1/4-inch variation in 10 feet . The surface across the joints shall be tested with a 10-foot straightedge as the joints are finished and any irregularities in excess of 1/4 inch shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.*

a. Construction. *Longitudinal construction joints shall be slip-formed or formed against side forms, without keyways, as shown in the plans.*

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

b. Contraction. *Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall be installed to the dimensions required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch wide and to the depth shown on the plans.*

c. Expansion. *Expansion joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the*

full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space over the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic. Any concrete bridging the joint space shall be removed for the full width and depth of the joint.

d. Keyways. *Keyways will not be allowed.*

e. Tie bars. *Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth. When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. These bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed in the female side of the keyed joint provided the installation is made without distorting the keyed dimensions or causing edge slump. If a bent tie bar installation is used, the tie bars shall be inserted through the keyway liner only on the female side of the joint. In no case shall a bent tie bar installation for male keyways be permitted.*

f. Dowel bars. *Dowel bars or other load-transfer units of an approved type shall be placed across joints in the manner as shown on the plans. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. A metal, or other type, dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on the plans. The caps or sleeves shall fit the dowel bar tightly and the closed end shall be watertight.*

The portion of each dowel painted with rust preventative paint, as required under paragraph 501-2.7 and shown on the plans to receive a debonding lubricant, shall be thoroughly coated with asphalt MC-70, or an approved lubricant, to prevent the concrete from bonding to that portion of the dowel. If free-sliding plastic-coated or epoxy-coated steel dowels are used, a lubrication bond breaker shall be used except when approved pullout tests indicate it is not necessary. Where butt-type joints with dowels are designated, the exposed end of the dowel shall be oiled.

Dowel bars and assemblies shall be checked for position and alignment. The maximum permissible tolerances on dowel bar alignment shall be in accordance with paragraph 501-5.2e(6). During the concrete placement operation, it is advisable to place plastic concrete directly on dowel assemblies immediately prior to passage of the paver to help maintain dowel position and alignment within maximum permissible tolerances.

Dowel bars at contraction joints may be placed in the full thickness of pavement by a mechanical device approved by the Engineer. The device shall be capable of installing dowel bars within the maximum permissible alignment tolerances. Dowels bars at longitudinal construction joints shall be bonded in drilled holes.

A dowel bar which is placed, found to be defective, and the bonding has set, shall be cut off flush with the pavement edge. A new bar shall be installed not closer than 3, but not more than 6, bar diameters from the specified bar location. When the dowels are defective for more than half of the bars in a slab length, all of the bars shall be cut off and new bars installed at half distance between placed dowels.

Dowels and tie bars shall be placed in longitudinal construction joints by bonding the dowels or tie bars into holes drilled into the hardened concrete. Holes approximately 1/8-inch to 1/4-inch greater in diameter than the dowel or tie bar shall be drilled with rotary-type core drills that must be held securely in place to drill perpendicularly into the vertical face of the pavement slab. Rotary-type percussion drills may be used provided that spalling of concrete does not occur. Any damage of the concrete shall be repaired by the Contractor using a method approved by the Engineer. Dowels or tie bars shall be bonded in the drilled holes using the approved epoxy resin material. Installation procedures shall be adequate to insure that the area around dowels is completely filled with epoxy grout. Epoxy shall be injected into the back of the hole and displaced by the insertion of the dowel bar. Bars shall be completely inserted into the hole and shall not be withdrawn and reinserted creating air pockets in the epoxy around the bar. The Contractor shall furnish a template for checking the position and alignment of the dowels. Dowels (or tie bars) shall be omitted when the center of a dowel will be within one slab thickness or one dowel spacing, whichever is less, from a planned joint, either contraction or construction.

g. Installation. *All devices used for the installation of expansion joints shall be approved by the Engineer.*

The top of an assembled joint device shall be set at the proper distance below the pavement surface and the elevation shall be checked. Such devices shall be set to the required position and line and shall be securely held in place by stakes or other means to the maximum permissible tolerances during the pouring and

finishing of the concrete. The premolded joint material shall be placed and held in a vertical position; if constructed in sections, there shall be no offsets between adjacent units.

Dowel bars and assemblies shall be checked for position and alignment. The maximum permissible tolerances on dowel bar alignment shall be in accordance with paragraph 501-5.2e(6). During the concrete placement operation, it is advisable to place plastic concrete directly on dowel assemblies immediately prior to passage of the paver to help maintain dowel position and alignment within maximum permissible tolerances.

When concrete is placed using slip-form pavers, dowels and tie bars shall be placed in longitudinal construction joints by bonding the dowels or tie bars into holes drilled into the hardened concrete. Holes approximately 1/8-inch to 1/4-inch greater in diameter than the dowel or tie bar shall be drilled with rotary-type core drills that must be held securely in place to drill perpendicularly into the vertical face of the pavement slab. Rotary-type percussion drills may be used provided that spalling of concrete does not occur. Any damage of the concrete shall be repaired by the Contractor in a method approved by the Engineer. Dowels or tie bars shall be bonded in the drilled holes using an epoxy resin material. Installation procedures shall be adequate to insure that the area around dowels is completely filled with epoxy grout. Epoxy shall be injected into the back of the hole and displaced by the insertion of the dowel bar. Bars shall be completely inserted into the hole and shall not be withdrawn and reinserted creating air pockets in the epoxy around the bar. The Contractor shall furnish a template for checking the position and alignment of the dowels. Dowel bars shall not be less than 10 inches from a transverse joint and shall not interfere with dowels in the transverse direction.

h. Sawing of Joints. *Joints shall be cut as shown on the plans. Equipment shall be as described in paragraph 501-4.1. The circular cutter shall be capable of cutting a groove in a straight line and shall produce a slot at least 1/8 inch (wide and to the depth shown on the plans. The top portion of the slot shall be widened by sawing to provide adequate space for joint sealers as shown on the plans. Sawing shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs. Sawing shall be carried on both during the day and night as required. The joints shall be sawed at the required spacing, consecutively in sequence of the concrete placement. Curing compound, if being used as the cure type, shall be reapplied in the initial sawcut and maintained for the remaining cure period. Curing compound shall not be applied, and used as the cure method, to any final concrete face that is to receive a sealant. All slurry and debris produced in the sawing of joints shall be removed by immediately by vacuuming and washing and not allowed to dry on the*

pavement surface. Under no conditions will slurry be allowed to enter the storm drain system.

The time of sawing shall vary but shall be done before uncontrolled shrinkage cracking occurs. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The sawed faces of joints shall be inspected for undercutting or washing of the concrete caused by early sawing. The saw cut shall not vary more than ½ inch from planned joint alignment. A planned joint shall not be saw cut if a crack has formed near the planned joint location. Sawing of the affected joint shall be discontinued when a crack develops ahead of the saw cut. An adequate number of sawing units shall be provided to complete the sawing before the development of shrinkage cracks. Quality and acceptability of the sawing will be based on comparisons with the accepted test section joints.

Directly after sawing of joints, and before any type of traffic is allowed on the pavement surface, the saw-cut joint shall be protected from moisture loss and debris intrusion. The minimum level of protection is an application of curing compound into the saw-cut, the installation of backer rod and continual sweeping of foreign debris. The Contractor will not allow any traffic on the concrete unless measures are taken to minimize foreign materials from being introduced into saw-cuts. No traffic, of any kind, will be allowed on pavements for which joint protection measures have not been adopted.

After expiration of the minimum concrete curing period specified by the joint seal manufacturer, the upper portion of the groove shall be widened by sawing to the width and depth required for the joint seal reservoir.

501-4.11 FINAL STRIKE-OFF, CONSOLIDATION, AND FINISHING.

a. Sequence. *The sequence of operations shall be the strike-off, floating and removal of laitance, straightedging, and final surface finish. The addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted.*

b. Finishing at Joints. *The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material; it shall be firmly placed without voids or segregation under and around all load-transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated as required in paragraph 501-4.8.a. After the concrete has been placed and vibrated adjacent to the joints, the finishing machine shall be operated in a manner to avoid damage or misalignment of joints. If uninterrupted operations of the finishing machine, to, over, and beyond the joints, cause segregation of*

concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the screed is approximately 8 inches from the joint. Segregated concrete shall be removed from the front of and off the joint; and the forward motion of the finishing machine shall be resumed. Thereafter, the finishing machine may be run over the joint without lifting the screed, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

If slipform paving, The slipform paver shall finish the surface and the paving lane edges as the equipment maintains forward motion. The finishing equipment shall be limited to the paver screed and a float. Floating may be accomplished by hand and by mechanical bull floating. Under no circumstances shall concrete slurry be accumulated on the surface of the finished concrete nor shall concrete slurry be permitted to run down the vertical edges of the placed pavement. Concrete slurry shall not be used to build up along the edges of the concrete to compensate for excessive edge slump.

c. Machine Finishing. *The concrete shall be spread as soon as it is placed, and it shall be struck off and screeded by a finishing machine. The machine shall go over each area as many times and at such intervals as necessary to give to proper consolidation and to leave a surface of uniform texture. Excessive operation over a given area shall be avoided. When side forms are used, the tops of the forms shall be kept clean by an effective device attached to the machine, and the travel of the machine on the forms shall be maintained true without lift, wobbling, or other variation tending to affect the precision finish. During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed for its entire length. When in operation, the screed shall be moved forward with a combined longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing, and so manipulated that neither end is raised from the side forms during the striking-off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.*

d. Hand Finishing. *Hand finishing methods will not be permitted, except under the following conditions: in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade; in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete when reinforcement is used.*

The screed for the surface shall be a least 2 feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or of other suitable

material covered with metal. Consolidation shall be attained by the use of suitable vibrators.

For odd-shaped slabs and concrete constructed after equipment breakdowns, a straightedge and a longitudinal float shall be provided. The handle for each shall be longer than one-half the width of pavement being finished. The longitudinal float shall be at least 12 feet long, of rigid design and construction, and substantially braced as to maintain a plane surface. As soon as placed and vibrated, the concrete shall be struck off, screeded to the crown and cross section detailed, and the entire surface floated.

e. Floating. *After the concrete has been struck off and consolidated, it shall be further smoothed and trued by means of a longitudinal float using one of the following methods:*

(1) Hand Method. *Long-handled floats shall not be less than 12 feet in length and 6 inches in width, stiffened to prevent flexibility and warping. The float shall be operated from foot bridges spanning but not touching the concrete or from the edge of the pavement. Floating shall pass gradually from one side of the pavement to the other. Forward movement along the centerline of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or laitance in excess of 1/8-inch thick shall be removed and wasted.*

(2) Mechanical method. *The Contractor may use a machine composed of a cutting and smoothing float(s), suspended from and guided by a rigid frame and constantly in contact with, the side forms or underlying surface. If necessary, long-handled floats having blades not less than 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. When the crown of the pavement will not permit the use of the mechanical float, the surface shall be floated transversely by means of a long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance in excess of 1/8-inch thick shall be removed and wasted. Successive drags shall be lapped one-half the length of the blade.*

f. Straight-edge Testing and Surface Correction. *After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a Contractor furnished 16-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8-inch thick shall be removed from the surface of the pavement and wasted. Any depressions shall*

be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the smoothness requirements of paragraph 501-5.2e(3). Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

501-4.12 SURFACE TEXTURE. *The surface of the pavement shall be finished with either a brush or broom, burlap drag, or artificial turf finish for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the Engineer.*

a. Brush or Broom Finish. *If the pavement surface texture is to be a type of brush or broom finish, it shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface, providing corrugations that are uniform in appearance and approximately 1/16 of an inch in depth.*

b. Burlap Drag Finish. *If a burlap drag is used to texture the pavement surface, it shall be at least 15 ounces per square yard. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately 1 foot from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface. The corrugations shall be uniform in appearance and approximately 1/16 of an inch in depth.*

c. Artificial Turf Finish. *Section not used.*

501-4.13 SKID-RESISTANT SURFACESSAW-CUT GROOVING. *If shown on the plans, skid resistant surfaces for asphalt pavements shall be provided by construction of saw-cut grooves. Saw-cut grooves must meet the requirements of Item P-621, Saw-cut Grooves, Section 49 of these specifications.*

501-4.14 CURING. *Immediately after finishing operations are completed and marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of*

concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-sawcut method is used to construct the contraction joint, the curing compound shall be applied to the sawcut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

a. Impervious Membrane Method. *The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. The curing compound shall be applied by mechanical sprayers with an overlapping coverage in two coats. The total coverage shall not be more than 150 square feet per gallon of curing compound. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound shall be stirred continuously by mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the Engineer, a double application rate shall be used to insure coverage. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.*

If requested, the Contractor shall remove all curing material by water blasting or light sandblasting at a time allowed by the Engineer to accommodate inspection of slabs for cracks. If within the 7 day curing period, curing compound will be immediately reapplied after inspection at the Contractor's expense.

b. Polyethylene Films. *The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units shall be lapped at least 18 inches. The sheeting shall be placed and weighted to cause it to remain in contact with the surface and sides. The sheeting shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the pavement. Unless otherwise specified, the sheeting shall be maintained in place for 7 days after the concrete has been placed. This method will not be approved for use in any areas subject to jet blast.*

c. Waterproof Paper. *The top surface and sides of the pavement shall be entirely covered with waterproofed paper. The units shall be lapped at least 18 inches. The paper shall be placed and weighted to cause it to remain in contact with the surface covered. The paper shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the slab. The surface of the pavement shall be thoroughly saturated prior to placing of the paper. Unless otherwise specified, the paper shall be maintained in place for 7 days after the concrete has been placed. This method will not be approved for use in any areas subject to jet blast.*

d. White Burlap-Polyethylene Sheets. *The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for 7 days after the concrete has been placed. This method will not be approved for use in any areas subject to jet blast.*

(1) Curing in Cold Weather. *The concrete shall be maintained at a temperature of at least 50 degrees F (10 degrees C) for a period of 72 hours after placing and at a temperature above freezing for the remainder of the curing time. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete injured by frost action shall be removed and replaced at the Contractor's expense.*

e. Water Method. *The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for 7 days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase."*

501-4.15 REMOVING FORMS. *Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated in paragraph 501-4.14. Major honeycombed areas shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-5.2(f).*

501-4.16 SEALING JOINTS. *The joints in the pavement shall be sealed in accordance with Item P-605, Joint Sealing Filler, Section 42 of these specificaitons..*

501-4.17 PROTECTION OF PAVEMENT. *The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense. The Contractor shall have available at all times, materials for the protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.*

501-4.18 OPENING TO TRAFFIC. *The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C 31 have attained a flexural strength of 550 pounds per square inch when tested in accordance with ASTM C 78, or a compressive strength of 3,500 psi, when tested in accordance with ASTM C 39. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion. The pavement shall be cleaned before opening for normal operations.*

501-4.19 REPAIR, REMOVAL, REPLACEMENT OF SLABS.

See Section 38 of these specifications, Concrete Repair, Removal and Replacement.

MATERIAL ACCEPTANCE

501-5.1 ACCEPTANCE SAMPLING AND TESTING. *All acceptance sampling and testing will be performed on site by a certified Concrete Testing Laboratory provided by the Contractor. The City of Los Angeles Standards Division technicians shall witness the testing by the Concrete Testing Laboratory. The Engineer shall be permitted unrestricted access to inspect the Contractor's Testing facilities and witness quality control activities and acceptance testing. The Contractor shall be responsible for sampling, curing, handling and testing of concrete beams. Coring for thickness determination necessary to determine conformance with the requirements specified in this section will be performed by the Contractor at locations designated by the Engineer.*

The Concrete Testing Laboratory performing these tests shall meet the requirements of ASTM C1077. The Contractor shall bear the cost of providing curing facilities and on site Concrete Testing Laboratory for all required sampling, curing, strength specimen tests per paragraph 501-5.1(a), and coring and filling operations, per paragraph 501-5.1b(1).

Concrete shall be accepted for strength and thickness on a lot basis. Lots for strength will be evaluated separately for each approved mix design. The Engineer must be present during testing for flexural strength, and thickness measurements will be performed by the Engineer.

A lot shall consist of a day's production not to exceed 3.600 square yards.

Testing organizations performing these tests shall meet the requirements of ASTM C 1077, including accreditation. The accreditation will include ASTM C 78. The Contractor shall bear the cost of providing curing facilities for the strength specimens, per paragraph 501-5.1a(3), and coring and filling operations, per paragraph 501-5.1b(1).

a. Flexural Strength.

(1) Sampling. *Each lot shall be divided into four equal sublots. One sample shall be taken for each sublot from the plastic concrete delivered to the job site. Sampling locations shall be determined by the Engineer in accordance with random sampling procedures contained in ASTM D 3665. The concrete shall be sampled in accordance with ASTM C 172.*

(2) Testing. *Two (2) specimens shall be made from each sample. Specimens shall be made in accordance with ASTM C 31 and the flexural strength of each specimen shall be determined in accordance with ASTM C 78. The flexural strength for each sublot shall be computed by averaging the results of the two test specimens representing that sublot.*

Immediately prior to testing for flexural strength, the beam shall be weighed and measured for determination of a sample unit weight. Measurements shall be made for each dimension; height, depth, and length, at the mid-point of the specimen and reported to the nearest tenth of an inch. The weight of the specimen shall be reported to the nearest 0.1 pound. The sample unit weight shall be calculated by dividing the sample weight by the calculated volume of the sample. This information shall be reported as companion information to the measured flexural strength for each specimen.

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method.

Slump, air content, and temperature tests will also be conducted by the quality assurance laboratory for each set of strength test samples, per ASTM C 31.

(3) Curing. *The Contractor shall provide adequate facilities for the initial curing of beams. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60 to 80 degrees F (16 to 27 degrees C), and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.*

The Contractor shall take all steps necessary to prevent loss of moisture. Relatively small amounts of surface drying of flexural specimens can induce tensile stresses in extreme fibers that will markedly reduce indicated flexural strength.

The Contractor shall fully control the test beams, on site, from sampling to preparation for testing, including the curing period. When a beam is to be tested, he shall submit the beam to the Concrete Testing Laboratory for testing on site. The Contractor shall supply the certified beam test equipment, approved by the Engineer on site for this testing, and shall provide certification results for the equipment prior to actual testing. The Contractor shall provide testing equipment in a testing trailer.

The Contractor shall provide the Engineer access to the curing facilities and testing equipment at all times, and shall use the testing equipment with the approval of the Engineer.

(4) Acceptance. *Acceptance of pavement for flexural strength will be determined by the Engineer in accordance with paragraph 501-5.2b.*

b. Pavement Thickness.

(1) Sampling. *Each lot shall be divided into four equal sublots and one core shall be taken by the Contractor for each sublot. Sampling locations shall be determined by the Engineer in accordance with random sampling procedures contained in ASTM D 3665. Areas, such as thickened edges, with planned variable thickness, shall be excluded from sample locations.*

Cores shall be neatly cut with a core drill. The Contractor shall furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes shall be filled by the Contractor with a non-shrink grout approved by the Engineer within one day after sampling.

(2) Testing. *The thickness of the cores shall be determined by the Engineer by the average caliper measurement in accordance with ASTM C 174.*

(3) Acceptance. *Acceptance of pavement for thickness shall be determined by the Engineer in accordance with paragraph 501-5.2c.*

c. Partial Lots. *When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Engineer agree in writing to allow overages or minor placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.*

Where three sublots have been produced, they shall constitute a lot. Where one or two sublots have been produced, they shall be incorporated into the next lot or the previous lot and the total number of sublots shall be used in the acceptance criteria calculation, i.e., n=5 or n=6.

d. Outliers. *All individual flexural strength tests within a lot shall be checked for an outlier (test criterion) in accordance with ASTM E 178, at a significance level of 5 percent. Outliers shall be discarded, and the PWL shall be determined using the remaining test values.*

501-5.2 ACCEPTANCE CRITERIA.

a. General. *Acceptance will be based on the following characteristics of the completed pavement:*

(1) *Flexural strength*
(2) *Thickness*
(3) *Smoothness*
(4) *Grade*
(5) *Edge slump*
(6) *Dowel bar alignment*

Flexural strength and thickness shall be evaluated for acceptance on a lot basis using the method of estimating percentage of material within specification limits (PWL). Acceptance using PWL considers the variability (standard deviation) of the material and the testing procedures, as well as the average (mean) value of the test results to calculate the percentage of material that is above the lower specification tolerance limit (L).

Acceptance for flexural strength will be based on the criteria contained in accordance with paragraph 501-5.2e(1). Acceptance for thickness will be based on the criteria contained in paragraph 501-5.2e(2). Acceptance for smoothness will be based on the criteria contained in paragraph 501-5.2e(3). Acceptance for grade will be based on the criteria contained in paragraph 501-5.2e(4).

The Engineer may at any time, not withstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, or improper slump. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

The Contractor will be required to compile, and keep current, all data relative to the determination of PWL values. Information shall contain, as a minimum:

(1) Layout of Lots and Sublots, per construction phase.

(2) Thickness data per sublot.

(3) Strength data per sublot.

b. Flexural Strength. *Acceptance of each lot of in-place pavement for flexural strength shall be based on PWL. The Contractor shall target production quality to achieve 90 PWL or higher.*

c. Pavement Thickness. *Acceptance of each lot of in-place pavement shall be based on PWL. The Contractor shall target production quality to achieve 90 PWL or higher.*

d. Percentage of Material Within Limits (PWL). *The percentage of material within limits (PWL) shall be determined in accordance with procedures specified in Section 110 of the General Provisions.*

The lower specification tolerance limit (L) for flexural strength and thickness shall be:

Lower Specification Tolerance Limit (L)	
Flexural Strength	*0.93 × strength specified in paragraph 501-3.1*
Thickness	*Lot Plan Thickness in inches – 0.50 inches*

e. Acceptance Criteria.

(1) Flexural Strength. *If the PWL of the lot equals or exceeds 90 percent, the lot shall be acceptable. Acceptance and payment for the lot shall be determined in accordance with paragraph 501-8.1.*

(2) Thickness. *If the PWL of the lot equals or exceeds 90 percent, the lot shall be acceptable. Acceptance and payment for the lot shall be determined in accordance with paragraph 501-8.1.*

(3) Smoothness. *As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 16-foot straightedge or other specified device. Surface smoothness deviations shall not exceed 1/4 inch from a 16-foot straightedge placed in any direction, including placement along and spanning any pavement joint edge.*

Areas in a slab showing high spots of more than 1/4 inch but not exceeding 1/2 inch in 16 feet shall be marked and immediately ground down with an approved grinding machine to an elevation that will fall within the tolerance of 1/4 inch or less. Where the departure from correct cross section exceeds 1/2 inch, the pavement shall be removed and replaced at the expense of the Contractor when so directed by the Engineer.

(4) Grade. *An evaluation of the surface grade shall be made by the Engineer for compliance to the tolerances contained below. Records shall be maintained showing all grade measurements.*

Lateral Deviation. *Lateral deviation from established alignment of the pavement edge shall not exceed plus or minus 0.10 foot in any lane.*

Vertical Deviation. *Vertical deviation from established grade shall not exceed plus or minus 0.04 foot at any point.*

(5) Edge Slump. *When slip-form paving is used, not more than 15 percent of the total free edge of each 500 foot segment of pavement, or fraction thereof, shall have an edge slump exceeding 1/4-inch and none of the free edge of the pavement shall have an edge slump exceeding 3/8-inch. (The total free edge of 500 feet of pavement will be considered the cumulative total linear measurement of pavement edge originally constructed as nonadjacent to any existing pavement; i.e., 500 feet of paving lane originally constructed as a separate lane will have 1,000 feet of free edge, 500 feet of fill-in lane will have no free edge, etc.). The area affected by the downward movement of the concrete along the pavement edge shall be limited to not more than 18 inches from the edge. When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive*

edge slump shall be removed and replaced at the expense of the Contractor when so directed by the Engineer.

If excessive edge slump is detected before initial set of the concrete, the Contractor, with the approval of the Engineer, may attempt a plastic repair. The Engineer will determine if the repair is acceptable. If repeated attempts to repair excessive edge slump are, in the Engineer's opinion, unacceptable, the affected slabs will be removed and replaced at the Contractor's expense. Repeated requests for edge slump repair will not be allowed. Corrective action to preclude future problems must be taken.

The following criteria shall be met for all attempted edge slump repairs:

a) Any additional material to be added to repair the edge slump shall contain a mixture of aggregate and mortar identical to the approved concrete mix. Plain mortar addition will not be allowed.

b) The repair area shall be vibrated into the existing material.

c) After vibration, material shall be screeded and finished as uniformly as possible with the surrounding concrete.

d) The repaired areas shall be textured and cured using the same processes as the surrounding concrete.

e) Repair shall not be attempted after curing compound has been applied .

(6) Dowel Bar Alignment. *Dowel bars and assemblies shall be checked for position and alignment. The maximum permissible tolerance on dowel bar alignment in each plane, horizontal and vertical, shall not exceed 2 percent or 1/4 inch per foot of a dowel bar. Vertical alignment of dowels shall be measured parallel to the designed top surface of the pavement, except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes, shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge.*

f. Removal and Replacement of Concrete. *Any area or section of concrete that is removed and replaced shall be removed and replaced back to planned joints. The Contractor shall replace damaged dowels and the requirements for doweled longitudinal construction joints in paragraph 501-4.10 shall apply to all contraction joints exposed by concrete removal. Removal and replacement shall be in accordance with Section 38 of these specifications, Concrete Repair, Removal and Replacement.*

CONTRACTOR QUALITY CONTROL

501-6.1 QUALITY CONTROL PROGRAM. *The Contractor shall develop a Quality Control Program in accordance with Section 12 of these specifications (FAA Section 100) of the General Provisions. The program shall address all elements that effect the quality of the pavement including but not limited to:*

- ***a.*** *Mix Design*
- ***b.*** *Aggregate Gradation*
- ***c.*** *Quality of Materials*
- ***d.*** *Stockpile Management*
- ***e.*** *Proportioning*
- ***f.*** *Mixing and Transportation*
- ***g.*** *Placing and Consolidation*
- ***h.*** *Joints*
- ***i.*** *Dowel Placement and Alignment*
- ***j.*** *Flexural or Compressive Strength*
- ***k.*** *Finishing and Curing*
- ***l.*** *Surface Smoothness*

501-6.2 QUALITY CONTROL TESTING. *The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to this specification and as set forth in the Quality Control Program. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content.*

A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

a. Fine Aggregate.

(1) Gradation. *A sieve analysis shall be made at least twice daily in accordance with ASTM C 136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.*

(2) Moisture Content. *If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter,*

two tests shall be made per day. Tests shall be made in accordance with ASTM C 70 or ASTM C 566.

b. Coarse Aggregate.

(1) Gradation. *A sieve analysis shall be made at least twice daily for each size of aggregate. Tests shall be made in accordance with ASTM C 136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.*

(2) Moisture Content. *If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C 566.*

c. Slump. *Four slump tests shall be performed for each lot of material produced in accordance with the lot size defined in Section 501-5.1. One test shall be made for each sublot. Slump tests shall be performed in accordance with ASTM C 143 from material randomly sampled from material discharged from trucks at the paving site. Material samples shall be taken in accordance with ASTM C 172.*

d. Air Content. *Four air content tests, shall be performed for each lot of material produced in accordance with the lot size defined in Section 501-5.1. One test shall be made for each sublot. Air content tests shall be performed in accordance with ASTM C 231 for gravel and stone coarse aggregate and ASTM C 173 for slag or other porous coarse aggregate, from material randomly sampled from trucks at the paving site. Material samples shall be taken in accordance with ASTM C 172.*

e. Unit Weight. *Four unit weight and yield tests shall be made in accordance with ASTM C 138. The samples shall be taken in accordance with ASTM C 172 and at the same time as the air content tests.*

f. Determination of Combined Grading. *The mathematical calculation of the combined aggregate grading, using the proportions selected for the design mixture, shall be used to determine the coarseness and workability factors. Each calculation result shall be plotted on a combined aggregate proportioning guide. Materials which have not been tested for grading shall not be placed in the mixer or incorporated into the work.*

g. Reporting Format*. Each grading test, for each stockpile, shall be plotted on charts which report sieve sizes and the variation from the selected grading. The Contractor shall plot the mathematical combined gradings of the*

results of testing of the stockpiles. The initial point shall be established by the mixture proportioning study. The point may be relocated based upon mixture adjustments made during placement of the test strip. Based upon stockpile samples, any deviation of the point, caused by material variability, which is along a line parallel to the control line of the Aggregate Proportioning Guide, is acceptable.

h. Location of Concrete Sampling. *Concrete samples for testing shall be collected by the Contractor from fresh concrete placed in front of the paver.*

501-6.3 CONTROL CHARTS. *The Contractor shall maintain linear control charts for fine and coarse aggregate gradation, slump, and air content.*

Control charts shall be posted in a location satisfactory to the Engineer and shall be kept up to date at all times. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and suspension Limits, or Specification limits, applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a potential problem and the Contractor is not taking satisfactory corrective action, the Engineer may halt production or acceptance of the material.

a. Fine and Coarse Aggregate Gradation. *The Contractor shall record the running average of the last five gradation tests for each control sieve on linear control charts. Specification limits contained in Tables 1 and 2 shall be superimposed on the Control Chart for job control.*

b. Slump and Air Content. *The Contractor shall maintain linear control charts both for individual measurements and range (i.e. difference between highest and lowest measurements) for slump and air content in accordance with the following Action and Suspension Limits.*

CONTROL CHART LIMITS			
Control Parameter	Individual Measurements		Range Suspension Limit
	Action Limit	Suspension Limit	
Slip Form:			
Slump	+0 to -1 inch	+0.5 to -1.5 inch	+/- 1.5 inch
Air Content	+/- 1.2%	+/- 1.8%	+/- 2.5%
Fixed Form			
Slump	+ 0.5 to -1 inch (13-25mm)	+1 to -1.5 inch (25-38mm)	+/- 1.5 inch (38mm)
Air Content	+/- 1.2%	+/- 1.8%	+/- 2.5%

The individual measurement control charts shall use the mix design target values as indicators of central tendency.

501-6.4 CORRECTIVE ACTION. *The Contractor Quality Control Program shall indicate that appropriate action shall be taken when the process is believed to be out of control. The Contractor Quality Control Program shall detail what action will be taken to bring the process into control and shall contain sets of rules to gauge when a process is out of control. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the following conditions exists.*

a. Fine and Coarse Aggregate Gradation. *When two consecutive averages of five tests are outside of the Tables 1 or 2 specification limits, immediate steps, including a halt to production, shall be taken to correct the grading.*

b. Fine and Coarse Aggregate Moisture Content. *Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5 percent, the scale settings for the aggregate batcher(s) and water batcher shall be adjusted.*

c. Slump. *The Contractor shall halt production and make appropriate adjustments whenever:*

(1) *one point falls outside the Suspension Limit line for individual measurements or range; or*
(2) *two points in a row fall outside the Action Limit line for individual measurements.*

d. Air Content. *The Contractor shall halt production and adjust the amount of air-entraining admixture whenever:*

(1) *one point falls outside the Suspension Limit line for individual measurements or range; or*

(2) *two points in a row fall outside the Action Limit line for individual measurements.*

Whenever a point falls outside the Action Limits line, the air-entraining admixture dispenser shall be calibrated to ensure that it is operating correctly and with good reproducibility.

501-6.5 REPORTS*. All results of testing, control charts, batch proportions, and other concrete control data shall be maintained in a book, at the*

jobsite with the Engineer, which shall reflect the results of all actions and is current to the preceding twenty-four hours. The Contractor shall report to the Engineer immediately, verbally at incidence, and followed by a written notification, of the breakdown of equipment, test failure reports, or construction deficiencies. Logged information shall include daily temperature, humidity and other pertinent environmental data.

In addition to the record book, the Contractor shall establish a truck load ticket tracking system, acceptable to the Engineer, to allow identification of the location of placement of each load of concrete, and to identify the components of the specific concrete placed. Load tickets shall be delivered to the Engineer for each truck load of concrete delivered. Tickets shall include the date, time, load volume, batch identification number or other information requested by the Engineer, which will allow the particular batch components to be identified. The Engineer will be responsible for noting the placement location on the tickets as delivered to the site.

Data shall be organized to present information on a lot/sublot basis for each construction phase. Test information shall be updated within 24 hours of placement of concrete or receipt of test results, as appropriate..

Gradation testing shall meet the requirements in Section 501-6.2 of these specifications.

METHOD OF MEASUREMENT

***501-7.1 MEASUREMENT**. See Section 37-3.*

BASIS OF PAYMENT

***501-8.1 PAYMENT.** See Section 37-4.*

TESTING REQUIREMENTS

ASTM C 31	*Making and Curing Concrete Test Specimens in the Field*
ASTM C 39	*Compressive Strength of Cylindrical Concrete Specimens*
ASTM C 70	*Surface Moisture in Fine Aggregate*
ASTM C 78	*Test for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)*

ASTM C 88	*Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate*
ASTM C 131	*Test for Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine*
ASTM C 136	*Sieve Analysis of Fine and Coarse Aggregates*
ASTM C 138	*Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete*
ASTM C 143	*Test for Slump of Hydraulic Cement Concrete*
ASTM C 172	*Sampling Freshly Mixed Concrete*
ASTM C 173	*Test for Air Content of Freshly Mixed Concrete by the Volumetric Method*
ASTM C 174	*Measuring Thickness of Concrete Elements Using Drilled Concrete Cores*
ASTM C 227	*Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)*
ASTM C 231	*Test for Air Content of Freshly Mixed Concrete by the Pressure Method*
ASTM C 289	*Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)*
ASTM C 295	*Petrographic Examination of Aggregates for Concrete*
ASTM C 114	*Chemical Analysis of Hydraulic Cement*
ASTM C 535	*Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine*
ASTM C 566	*Total Evaporable Moisture Content of Aggregates by Drying*
ASTM C 642	*Test for Density, Absorption, and Voids in Hardened Concrete*

ASTM C 666	*Resistance of Concrete to Rapid Freezing and Thawing*
ASTM C 1077	*Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction And Criteria for Laboratory Evaluation*
ASTM C 1260	*Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)*
ASTM D 3665	*Random Sampling of Paving Materials*
ASTM D 4791	*Test Method for Flat or Elongated Particles in Coarse Aggregate*
ASTM E 178	*Dealing With Outlying Observations*
ASTM E 1274	*Test for Measuring Pavement Roughness Using a Profilograph*
AASHTO T 26	*Quality of Water to be Used in Concrete*

MATERIAL REQUIREMENTS

ASTM A 184	*Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement*
ASTM A 185	*Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement*
ASTM A 497	*Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement*
ASTM A 615	*Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement*
ASTM A 704	*Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement*
ASTM A 714	*Specification for High-Strength Low-Alloy Welded and Seamless Steel Pipe*

ASTM A 996	*Specification for Rail-Steel and Axle Steel Deformed Bars for Concrete Reinforcement*
ASTM C 33	*Specification for Concrete Aggregates*
ASTM C 94	*Specification for Ready-Mixed Concrete*
ASTM C 150	*Specification for Portland Cement*
ASTM C 171	*Specification for Sheet Materials for Curing Concrete*
ASTM C 260	*Specification for Air-Entraining Admixtures for Concrete*
ASTM C 309	*Specification for Liquid Membrane-Forming Compounds for Curing Concrete*
ASTM C 494	*Specification for Chemical Admixtures for Concrete*
ASTM C 595	*Specification for Blended Hydraulic Cements*
ASTM C 618	*Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete*
ASTM C 881	*Specification for Epoxy-Resin Base Bonding System for Concrete*
ASTM C 989	*Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars*
ASTM D 1751	*Specification for Preformed Expansion Joint Filler for Concrete Paving and Structura Construction (Nonextruding and Resilient Bituminous Types)*
ASTM D 1752	*Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving And Structural Construction*
ACI 305R	*Hot Weather Concreting*
ACI 306R	*Cold Weather Concreting*
ACI 309	*Guide for Consolidation of Concrete*

MIL-DTL-24441/20a
Department of Defense *(1999)_Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III*

END ITEM P-501

37-2 TEMPORARY LOAD-BEARING SURFACING

Areas of limited night construction are identified on the plans. These construction areas are within the Taxiway and/or Runway Safety Areas of the airport and are subject to operating jet aircraft traffic during daytime hours. Work in these areas will be limited to the hours indicated on the plans and/or in Section 11 - Project Phasing, of these Specifications. The Contractor will be required to provide stable, smooth surfaces in such areas to accommodate aircraft traffic between nightly work shifts.

It is anticipated that concrete pavement work in these areas will require at least two shifts – one for demolition and/or excavation and placement of formwork, and one for placement of high-early strength concrete. The plans include one approved method of providing such temporary surfacing in the form of steel-plated beam structures to cover excavations and formwork. The inclusion of these details in the plans is not to be construed as being the only method of meeting the requirements. The Contractor may submit to the Engineer proposed alternate methods of providing load-bearing capacity, jet-blast resistance and smoothness of grade for these interim periods.

To be considered for approval, proposals must include engineering calculations showing conformance to the following criteria:

37-2.1. Loading

The Contractor shall provide stamped, engineering calculations showing that the surfacing method proposed will withstand aircraft loading up to and including FAA Design Group V aircraft in conformance with the requirements set forth in the Appendices to FAA Advisory Circular 150-5320-6, Pavement Design. Load calculations shall include support for the following aircraft:

(1) Dual-wheel, 48,800# per wheel gear assembly of the Boeing 727; 34 inch center-to-center wheel spacing;

(2) Dual-Tandem (four-wheel), 57,900# per wheel, gear assembly of the Boeing 747-800; 46.8 inch transverse and 56.5 inch longitudinal center-to-center wheel spacing; and

(3) Tridem (six-wheel), 58,900# per wheel, gear assembly of the Airbus A380, 53 inch transverse and 67 inch longitudinal center-to-center wheel spacing.

Contact tire pressure should be assumed to be 221 psi.

37-2.2 Jet Blast

The Contractor shall provide stamped, engineering calculations showing the ability of the proposed temporary surface to withstand jet blast from the outboard engine of the B-747 traveling on the subject taxiway or runway, without producing Foreign Object Debris (FOD) or dust control hazards.

37-2.3 Grade and Smoothness

The proposed method shall satisfy all FAA's Runway and Taxiway Safety Area requirements for smoothness of grade. No lips or drop-offs will be allowed between temporary panels or surfaces and the adjacent pavement, or between new slabs and adjacent pavement. Construction shall not result in lips greater than 1 inch, for pavement traveled by aircraft, or 3 inches, for edges between old and new surfaces at edges and ends not traveled by aircraft. Grades shall be between 0% and -5% measured from the remaining, existing pavement edge.

No work may proceed in these nighttime construction areas until a method of providing temporary load-bearing surfacing has been approved in writing by the Engineer.

If, at any time after the construction of a previously approved method of temporary surfacing, the Engineer determines that the Contractor's methods are not, or are no longer, satisfactory, and/or that there are issues of concern regarding support of loads, jet blast (including potential dust or FOD issues) or that grade criteria are not being met, work in these areas will be stopped. Alternate methods of temporary surfacing that will allow safe daytime operation of aircraft must then be resubmitted and approved before work can restart. No additional contract time will be allowed to the Contractor for delays due to such shutdowns and resubmittals.

Providing such surfacing shall be considered incidental to the construction of the high-early strength concrete pavement, and no separate payment will be made for this work.

37-3 METHOD OF MEASUREMENT

Portland cement concrete pavement shall be measured by the number of cubic yards of either plain or reinforced pavement, constructed as specified, in-place, completed and accepted by the Engineer.

Saw-cut grooving shall be measured and paid under Section 49 of these specifications, Saw-cut Grooves.

37-4 BASIS OF PAYMENT

Payment for accepted concrete pavement shall be made at the contract unit price per square yard, for pavement of the type and thickness indicated in the bid schedule, adjusted in accordance with paragraph 501-8.1a, subject to the limitation that:

The total project payment for concrete pavement shall not exceed [ ] percent of the product of the contract unit price and the total number of square yards of concrete pavement used in the accepted work (See Note 2 under Table 3).

Payment shall be full compensation for all labor, materials, tools, equipment, and incidentals required to complete the work as specified herein and on the drawings.

* *

The Engineer shall specify a value ranging from 100 percent to 106 percent. When the total project payment for Item P-501 pavement exceeds the contract unit price, any AIP or PFC funds used to pay the excess may require an amendment to the AIP grant or PFC application for the project.

* *

a. Basis of Adjusted Payment. The pay factor for each individual lot shall be calculated in accordance with Table 3. A pay factor shall be calculated for both flexural strength and thickness. The lot pay factor shall be the higher of the two values when calculations for both flexural strength and thickness are 100 percent or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either flexural strength or thickness is 100 percent or higher. The lot pay factor shall be the lower of the two values when calculations for both flexural strength and thickness are less than 100 percent .

TABLE 3. PRICE ADJUSTMENT SCHEDULE [1]

Percentage of Material Within Specification Limits (PWL)	Lot Pay Factor (Percent of Contract Unit Price)
96 – 100	106
90 – 95	PWL + 10
75 – 90	0.5PWL + 55
55 – 74	1.4PWL – 12
Below 55	Reject [2]

[1] ALTHOUGH IT IS THEORETICALLY POSSIBLE TO ACHIEVE A PAY FACTOR OF 106 PERCENT FOR EACH LOT, ACTUAL PAYMENT IN EXCESS OF 100 PERCENT SHALL BE SUBJECT TO THE TOTAL PROJECT PAYMENT LIMITATION SPECIFIED IN PARAGRAPH 501-8.1.

[2] The lot shall be removed and replaced. However, the Engineer may decide to allow the rejected lot to remain. In that case, if the Engineer and Contractor agree in writing that the lot shall not be removed, it shall be paid for at 50 percent of the contract unit price AND THE

TOTAL PROJECT PAYMENT LIMITATION SHALL BE REDUCED BY THE AMOUNT WITHHELD FOR THE REJECTED LOT.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph 501-8.1. Payment in excess of 100 percent for accepted lots of concrete pavement shall be used to offset payment for accepted lots of concrete pavement that achieve a lot pay factor less than 100 percent.

b. Payment. See Section 37-5.

c. Basis of adjusted payment for Smoothness. Price adjustment for pavement smoothness will apply to the total area of concrete within a section of pavement and shall be applied in accordance the following equation and schedule:

(Sq yds in section) x (original unit price per sq yds) x PFm = reduction in payment for area within section:

Average Profile Index (Inches per mile) pavement strength rating			Contract Unit Price Adjustment PFm
<30,000#	< 30,000#	Short Sections	
0 - 7	0 - 10	0 - 15	0.00
7.1 - 9	10.1 - 11	15.1 - 16	0.02
9.1 - 11	11.1 - 12	16.1 - 17	0.04
11.1 - 13	12.1 - 13	17.1 - 18	0.06
13.1 - 14	13.1 - 14	18.1 - 20	0.08
14.1 - 15	14.1 - 15	20.1 - 22	0.10
15.1 & up	15.1 & up	22.1 & up	corrective work required

Payment shall be made at the contract unit price per plain or reinforced PCC pavement of the type and thickness indicated in the bid schedule. This price shall be full compensation for furnishing all materials, and for all labor, supervision, equipment tools, and incidentals necessary to complete the item.

No separate payment will be made for: constructing the item under construction sequencing restrictions, including limited access or nighttime work area restriction.

Saw-cut grooves will be measured for payment under Section 49 of these specifications.

Payment will be made under:

Item 37.1 Plain PCC Pavement, ____" Thick.....per square yard

Item 37.2 Reinforced PCC Pavement, ____" Thick .....per square yard

Item 37.3 <Item Name> .....per <unit>

END OF SECTION 37

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Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. Jointed Portland Cement Concrete pavement
   a) with reinforcement, or
   b) without reinforcement
2. In accordance with the plans and specifications.

II. MATERIALS

A. AGGREGATES

1. Reactivity
   a) Test for alkali silica reactivity (ASR)
   b) Both coarse and fine aggregate
   c) per ASTM C1260
   d) Expansion
      (1) expansion ≤ 0.10% at 16 days acceptable
      (2) expansion > 0.10% at 16 days not acceptable
         (a) make further tests on combination of
            (i) aggregates
            (ii) actual cement proposed
            (iii) proposed reactivity mitigating agents
               (a) fly ash
               (b) other
         (b) Test per
            (i) ASTM C1260 or
            (ii) ASTM C1567
            (iii) expansion ≤ 0.10% at 30 days acceptable
            (iv) expansion ≥ 0.10% at 30 days not acceptable
               (a) revise and retest materials/mix until acceptable ASR test results attained, or
               (b) find alternate aggregate source
2. Fine Aggregate
   a) Conform to:
      (1) ASTM C33
   b) Gradation – per Table 1
      (1) tested per ASTM C136
      (2) except as otherwise qualified under Section 6, ASTM C33

TABLE 1. GRADATION FOR FINE AGGREGATE (ASTM C 33)

Sieve Designation (Square Openings)	Percentage by Weight Passing Sieves
3/8 inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

3. Coarse Aggregate
    a) Conform to:
        (1) ASTM C33
            (a) within separated size groups
        (1) Gradation – Contractor to select from Table 2
            (b) Tested per ASTM C136

Table 2 GRADATION FOR COARSE AGGREGATE ASTM C 33			
Sieve Designations (square openings)	**Percentage by Weight Passing Sieves**		
inches	From 1-1/2" to No. 4 (#4)	From 1-1/2" to No. 4 (#67)	From 1" to No. 4 (#57)
2	100	-	-
1-1/2	90-100	-	100
1	20-55	100	95—100
¾	0-15	90-100	-
½	-	-	25—60
3/8	0-5	20-55	-
No. 4	-	0-10	0—10
No. 8	-	0-5	0—5

    b) if nominal maximum size > 1 inch
        (1) furnish in two size groups
    c) aggregate shall be
        (1) crushed stone, or
        (2) crushed or uncrushed gravel, or
        (3) air-cooled blast furnace slag, or
        (4) crushed recycled concrete pavement, or
        (5) combination thereof
    d) Particles shall:
        (1) be clean, hard, uncoated
        (2) meet requirements for ASTM Class 4M
        (3) have dust removed by washing
    e) Flat and elongated pieces limitation
        (1) definition:
            (a) ratio of max:min dimensions > 5:1
        (2) not more than 8 % flat or elongated
        (3) as tested per ASTM D4791
    f) Durability requirement
        (1) percentage wear $\leq$ 40%
        (2) tested per ASTM C131 or C535
        (3) on case-by-case basis may approved
            (a) less durable aggregate with
                (i) if 5-year service record
                (ii) under similar exposure conditions
4. Aggregate Susceptibility to Disintegration (D) Cracking

a) do not use aggregates with history of D-cracking
b) Contractor to submit written certification that
(1) no D-cracking history exists
(2) aggregate meets Caltrans requirements
c) Acceptable aggregates
(1) crushed stone
(a) durability factor per ASTM C 666 > 95 and
(b) all other quality tests fulfilled
(2) crushed gravel and sand-gravel aggregates
(a) Not required to meet freeze-thaw durability ratings
(b) shall be approved by Caltrans

B. CEMENT
1. Shall be
a) Type II or V for regular strength (28-day) strength concrete
b) Type V for High-Early strength concrete.
c) conforming to ASTM C150
2. If potential for ASR exists
a) specify low-alkali (< 0.6% total equivalent alkalinity) cement
3. Verify total alkalis independently via ASTM C114
4. Will reject cement
a) if partially set
b) contains lumps of caked cement
c) is salvaged from discarded or used bags

C. CEMENTITIOUS MATERIALS
1. Fly Ash or Natural Pozzolan
a) meet requirements of ASTM C618 Type F
b) loss of ignition < 6%
c) not acceptable
(1) from furnace operations utilizing
(a) liming materials
(b) soda ash (sodium carbonate)
d) furnish vendor's certified test report for each shipment of fly ash, or
~~e) Engineer will test~~
2. Blast Furnace Slag
a) shall be Ground Granulated Blast Furnace (GGBF) slag
(1) conforming to ASTM C989
(a) Grade 100 or
(b) Grade 120
(2) use at rate of 25%-55% of total cementitious by mass

D. PREMOLDED JOINT FILLER
1. Conform to
a) ASTM D1751, or
b) ASTM D1752
(1) Type II, or
(2) Type III
2. Shall be
a) punched to admit dowels
b) single piece for full depth and width of joint
(1) unless otherwise approved by the Engineer
3. if two pieces required for joint
a) abut ends and fasten securely by
(1) stapling or

(2) other positive fastening means approved by Engineer

4. Joint filler material must be compatible with joint sealant

E. JOINT SEALER

1. Meet requirements of Section 42 – Joint Sealing Filler P-605
2. Be of type specified on plans

F. STEEL REINFORCEMENT

~~1. Welded deformed steel fabric~~

~~a) conform to ASTM A497~~

~~2. Welded wire fabric~~

~~a) conform to ASTM A185~~

~~3. Bar Mats~~

~~a) conform to ASTM A184 or A704~~

4. Deformed steel bars

a) conform to ASTM A615 or ASTM A996

(1) Grade 50 or 60 not acceptable if bending required

(a) Use Grade 40 if bending required

G. DOWEL AND TIE BARS

1. Tie bars

a) Deformed steel bars

(1) conform to ASTM A615 or ASTM A996

(a) Grade 50 or 60 not acceptable if bending required

(i) Use Grade 40 if bending required

2. Dowel Bars

a) Plain steel bars

(1) Conform to ASTM A615 or ASTM A966

(2) free from

(a) burring

(b) other deformation

b) High-strength dowel bars

(1) conform to ASTM A714

(a) Class 2, Type S

(i) Grade I, II or III

(b) bare-finish

c) Before delivery to site

(1) paint

(a) one coat

(b) conforming to MIL-DTL-24441/20A

(i) SSPC Paint 5, or

(ii) SSPC Paint 25

d) Collars

(1) full circular device

(a) support dowel and retain epoxy

(i) until epoxy hardens

(2) metal or plastic

e) Sleeves

(1) metal, or

(a) other approved type

(2) must

(a) cover 2-3 inches of dowel

(b) have closed end

(c) have suitable stop

(i) hold bar at least 1 inch from end of closed sleeve

(d) not collapse during construction

H. WATER
1. clean and free of
   a) oil, salt, acid, alkali, sugar, vegetable matter
   b) other substances injurious to finished product.
2. test per AASHTO T26
   a) if known to be potable may be used without testing

I. COVER MATERIAL FOR CURING
1. Liquid membrane-forming
   a) Conform to
      (1) ASTM C309
         (a) Type 2
            (i) Class B, or
            (ii) Class A
               (a) wax based only
2. White polyethylene film
3. White burlap-polyethylene sheeting
4. Waterproof paper

J. ADMIXTURES
1. Must be approved by Engineer
2. Submit
   a) certificates showing compliance with requirements
   b) complete test results if requested by Engineer
   c) Engineer may test samples from production to determine uniformity
3. Air-entraining Admixtures
   a) Conform to ASTM C260
   b) consistently entrain air content
      (1) in specified ranges
      (2) under field conditions
   c) Must be compatible with any water reducer used
4. Chemical Admixtures
   a) Water-reducing
      (1) High Range water reducers not allowed
         (a) except for High-Early Strength concrete mix designs
   b) Set-retarding
   c) Set-accelerating
   d) Conform to ASTM C494
      (1) including flexural strength test
5. Compatibility
   a) admixtures shall be
      (1) compatible with each other
      (2) from same manufacturer

K. EPOXY RESIN
1. Conform to ASTM C881, Type I, Grade 3, Class C
   a) Class A or B if surface temperate < 60 deg F

L. MATERIAL ACCEPTANCE
1. Prior to use Engineer must approve:
   a) certified test reports
   b) show
      (1) ASTM test numbers
      (2) test results
      (3) statement re: material pass or fail

III. MIX DESIGN

A. PROPORTIONS

1. Design to achieve flexural strength of 650 psi
   a) at 28 days for regular mixes
   b) at [ ] hrs for high-early strength mixes

NOTES TO ENGINEER: value other than 650 psi should be used if different number used in design calculations, however 650 is recommended based on historical consistency obtainable during construction

   c) design procedure
      (1) Portland Cement Association's manual
         (a) "Design and Control of Concrete Mixtures".
            (i) Chapter 9
      (2) In addition, provide Combined Aggregate Gradation per III.B
2. To ensure that acceptance are met or exceeded
   a) must design to higher strength than specified
   b) amount of overdesign depends on
      (1) standard deviation of test results
      (2) accuracy of strength determination from historical results
3. Minimum cementitious material – per cubic yard
   a) 564 pounds cementitious material
4. Maximum Water/ Cement Ratio (W/C)
   a) 0.45
5. Submit Mix Design
   a) prior to start of paving operations
   b) Include:
      (1) Strengths
         (a) For Regular Mixes
            (i) 7-day
            (ii) 28-day
         (b) For High-Early Strength Mixes
            (i) 1-hour
            (ii) 2-hour
            (iii) 4-hour
            (iv) 8-hour
            (v) 1-day
            (vi) 2-day
            (vii) 7-day
            (viii) 28-day
            (ix) planned age at opening if different from above
      (2) copies of test results
         (a) test dates
         (b) complete list of materials
            (i) cement
            (ii) fly ash
            (iii) coarse aggregate
            (iv) fine aggregate
            (v) water
            (vi) admixtures
   c) show:
      (1) for each component
         (a) type
         (b) brand

(c) source
(d) amount
(2) fineness modulus of fine aggregate
(3) air content
d) Submit no later than 30 days before intended start of paving
e) Mix shall not be older than 90 days
f) Engineer must approve Job Mix prior to paving
g) Mix Design Format
(1) Report Format
(2) Graph of flexural strength vs. time per III.A.5.b.1

6. Submit revised Mix Design if
a) change in sources of materials made
7. Test Specimens
a) Prepare per ASTM C192
b) Test Specimens per ASTM C78
8. Slump
a) per ASTM C143
b) for Side-form: 1 to 2 inches
c) for Slip-form: ½-inch to 1-1/2-inch

B. COMBINED AGGREGATE GRADING
1. In addition to mix requirements per III.A.1.c, check combined gradation of aggregates with
a) Procedures in US Air Force publication, "Proportioning Concrete Mixtures with Graded Aggregates, A Handbook for Rigid Airfield Pavements".
(1) download from
(a) http://www.wbdg.org/ccb/AF/AFETL/etl_97_5.pdf
2. Include
a) Aggregate Grading Controls
(1) reports to include screens:
(a) 1½", 1", 3/4" ½" 3/8", No.4, No. 8, No. 16, No. 30, No. 50, and No. 100.
b) Percent Aggregate Retained Graph
(1) plot on standard soils gradation graph
(2) percent retained on each screen
(a) Y-axis is percent retained
(b) X-axis is sieve size
(3) should be smooth curve transitioning from coarse to fine
(c) no significant valley or peak
(i) between 3/8-inch sieve and smallest reporting sieve
c) Coarseness and Workability Factor
(1) Coarseness Factor
(a) Definition:
(i) percent of combined aggregate retained above the No. 8 sieve which is also retained above the 3/8" sieve
(b) Calculation
(i) divide percent of material retained above the 3/8" sieve by the percent retained above the No. 8 sieve, times 100:

$$\text{Coarseness Factor} = (100) \times \frac{\text{(\% retained above 3/8 sieve)}}{\text{(\% retained above \#8 sieve)}}$$

(2) Workability Factor

(c) Definition:
(i) percentage of combined aggregate finer than the No. 8 sieve
(d) Calculation of Adjustment:
(i) increase linearly at a rate of 2.5 units for each 72.5 PCY of cementitious material above or below a baseline cementitious materials content of 564 PCY
(e) Plot on Chart similar to Figure 1, below:
(i) Coarseness Factor limits
(a) not greater than 75
(b) not less than 45
(ii) Workability Factor limits
(a) above Control Line
(b) within workability box defined by Control Lines

3. Engineer's approval will consider
a) job mix gradation values as submitted
b) allowance for variance based on historical test results from source
(3) may reject if historical variance overlay on submitted values fall outside limits

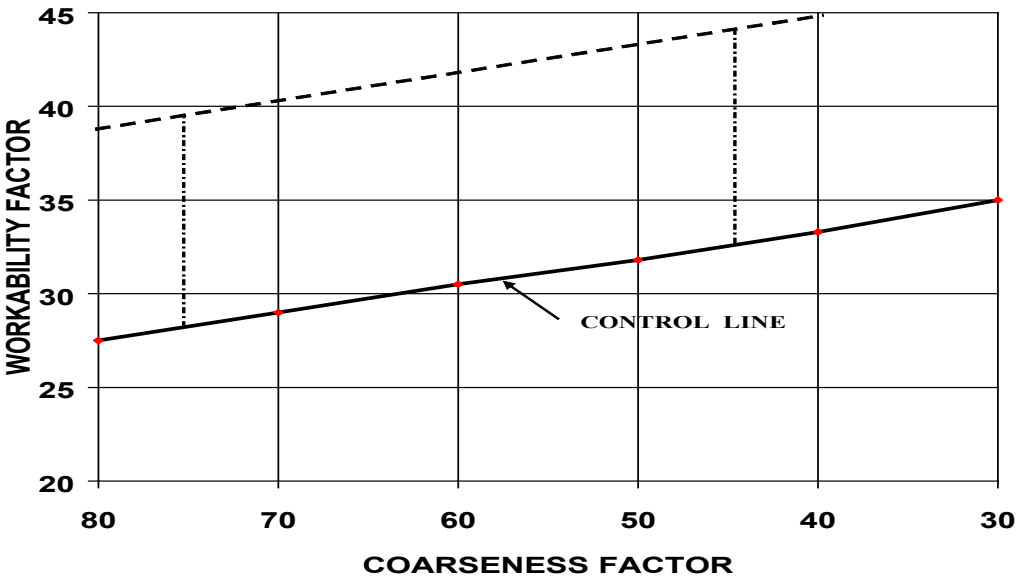

FIGURE 1 – AGGREGATE PROPORTIONING GUIDE

C. CEMENTITIOUS MATERIALS
1. Fly Ash
a) if used shall be 20%-30% of total cementitious material by weight
(1) unless used as ASR amelioration
(a) higher % may be approved by Engineer
(b) higher amounts may preclude slip-form paving due to set delay
b) if used with GGBS, max replacement rate 10% of total cementitious

2. Ground Slag – GGBS
    a) Type I or Type II
    b) may be 25% to 55% of total cementitious material by weight
    c) if slip forming and temps < 55 deg F, limit shall not exceed 30%

NOTES TO ENGINEER: Acceptance of Fly Ash mandated by Federal law unless sufficient technical reasons exist to disallow.

D. ADMIXTURES
1. Air-Entraining
    a) add so as to ensure uniform distribution
    b) air content to be based on trial mixes to produce
        (1) required plasticity
        (2) required workability
    c) Target air content
        (1) For 1.5" max aggregate: 2.5%
        (2) For 1" max aggregate: 3.0%
    d) Test air content via
        (1) ASTM C231 for gravel or stone mixes
        (2) ASTM C173 for
            (a) slag mixes
            (b) porous aggregates
2. Chemical
    a) Water-reducing, set-controlling, or other approved
    b) Add and mix per manufacturers recommendations
    c) Test trial mixes per ASTM C494

E. TESTING LABORATORY
1. Laboratory developing Job Mix
    a) shall meet requirements of
        (1) ASTM C1077
        (2) ASTM C78
    b) Submit laboratory certification to Engineer
        (1) prior to start of mix design
        (2) include evidence
            (a) lab is inspected/accredited for test methods required herein
            (b) by nationally recognized inspection/accreditation organization

IV. CONSTRUCTION METHODS

A. EQUIPMENT
1. General
    a) equipment shall be approved by the Engineer for
        (1) design
        (2) capacity
        (3) mechanical condition
    b) shall be at job site ahead of paving
        (1) to allow adequate inspection and approval time
    c) [OPTIONAL: Central Plant Mixer will be required for this project.]
2. Batch Plant and Equipment
    a) Shall conform to ASTM C94
3. Mixers and Transportation Equipment
    a) General
        (1) May be mixed in truck mixers

(a) wholly or in part
(2) Each mixer to show
(a) manufacturer nameplate with
(i) capacity of drum in volume
(ii) speed of rotation of drum or blades

b) Central Plant Mixer
(1) shall be examined daily for changes in condition due to
(a) accumulation of hard concrete
(b) blade wear
(2) replace pickup and throwover blades
(a) when worn ¾ inch or more
(3) Contractor to keep copy of manufacture's design on hand showing
(a) blade dimensions
(i) original height and depth
(b) blade arrangement

c) Truck Mixers and Agitators
(1) Conform to ASTM C94

d) Nonagitator Trucks
(1) Conform to ASTM C94

4. Finishing Equipment
a) Standard method: approved slip-form paver
(1) designed specifically to
(a) spread, consolidate, screed and float-finish concrete pavement
(b) in one complete pass
(2) result is dense, homogeneous pavement
(3) requires minimum of hand finishing
(4) heavy-duty with following characteristics
(a) per foot of paving lane width:
(i) weight 2200#
(ii) minimum 6.0 horsepower

b) Side-form method approved for:
(1) project < 500 sq yds or
(2) individual placements < 500 sq yds, or
(3) irregular areas, or
(4) areas inaccessible to slip-form paving equipment

c) hand screeding and float finishing
(1) on in small irregular areas
(2) if approved by the Engineer

5. Vibrators
a) Internal Type only
(1) 8,000-12,000 vibrations per minute
(2) average amplitude 0.02 -0.05 inches
(3) except for irregular areas
(a) when approved by the Engineer
(b) operate per ACI 309, Guide for Consolidation of Concrete

b) Number, spacing, frequency
(1) as necessary to produce dense, homogeneous pavement
(a) must meet recommendations in ACI 309, Guide for Consolidation of Concrete
(2) power to operate shall be available on paver
(3) shall be automatically controlled
(a) stop when forward motion stops

(4) shall be equipped with electronic or mechanical means of monitoring status
(a) check minimum twice per day
(b) or when requested by Engineer

6. Concrete Saws
   a) provide saws adequate in
      (1) number
      (2) power
   b) keep at the site at all times
      (1) one standby saw
      (2) adequate supply of blades
7. Side Forms
   a) shall be steel
   b) dimensions
      (1) sections not less than 10 ft in length
      (2) depth equal to pavement thickness at edge
      (3) base width equal to or greater than depth
   c) use curved forms of proper radius for < 100 ft radius
   d) provide with devices to adequately secure in place without
      (1) visible spring or settlement
         (a) from consolidating and finishing operations
   e) Do not forms which
      (1) have battered top surfaces
      (2) are bent, twisted or broken
      (3) are built-up
         (a) except if approved by the Engineer
   f) Frames shall have
      (1) true planes
         (a) top face: within 1/8-inch in 10 ft
         (b) upstanding leg: within ¼-inch
      (2) provisions for locking ends and abutting sections together
   g) wood forms
      (1) only in special situations
      (2) if approved by the Engineer
8. Pavers
   a) shall be
      (1) fully-energized
      (2) self-propelled
      (3) specifically designed to for constructing concrete pavement
         (a) placing
         (b) consolidating
         (c) finishing
         (d) true to
            (i) grade
            (ii) tolerances
            (iii) cross-section
   b) shall be of sufficient
      (1) weight
      (2) power
      (3) to construct lane width required
         (a) with adequate forward speed
         (b) without

(i) displacement
(ii) instability

(4) transverse

(a) longitudinal
(b) vertical

c) equipped with control devices
(1) vertical
(2) horizontal

B. FORM SETTING

1. Set sufficiently in advance to allow for continuous placement of concrete
2. After forms set to proper grade
   a) thoroughly tamp underlying course
      (1) mechanically, or
      (2) with hand tampers
      (3) inside and outside of form
   b) stake forms sufficiently to maintain in place
      (1) use minimum of 3 stakes per form side
      (2) stakes shall extend at least 3 ft into ground
         (a) or deeper if necessary to maintain grade control
   c) form sides shall be tightly locked
      (1) free from play in any direction
      (2) shall not deviate more than 1/8 inch at any joint
      (3) to withstand visible spring or movement
         (a) from consolidating and finishing equipment
3. immediately prior to concrete placement
   a) clean and oil forms
   b) check and correct alignment and grade

C. CONDITIONING OF UNDERLYING SURFACE

1. Widen underlying course minimum 3 feet beyond paving width
   a) to support paver
   b) without noticeable displacement
2. Areas to support paver
   a) shall be trimmed and graded to plan elevation and profile
      (1) with properly designed machine
      (2) using positive grade control system utilizing
         (a) lasers, or
         (b) stringlines, or
         (c) guidewires
   b) if density disturbed by trimming
      (1) correct and retest prior to concrete placement
         (a) except for stabilized subbase courses
      (2) as required by Engineer
      (3) damage to stabilized subbases
         (a) correct full depth
         (b) at Contractor's expense
3. If traffic allowed to use prepared grade
   a) check and correct immediately before concrete placement
4. Prepared grade
   a) moisten immediately ahead of paver
      (1) to prevent rapid loss of concrete moisture
      (2) do not saturate
   b) protect from frost

D. CONDITIONAL OF UNDERLYING SURFACE – SIDE-FORM AND FILL-IN LANE CONSTRUCTION
1. moisten immediately ahead of paver
    a) to prevent rapid loss of concrete moisture
    b) do not saturate
2. correct and retest if damaged
    a) by hauling or other equipment
    b) if stabilized subbase damaged
        (1) Contractor to repair full depth
3. provide and operate template on forms
    a) immediately in advance of concrete placement
    b) template shall be
        (1) propelled only by hand – not attached to equipment
        (2) adjustable to accommodate changes to underlying grade
        (3) shall provide accurate retest of the grade ahead of concrete placement
        (4) maintain in accurate adjustment
            (a) check daily
    c) repair surfaces not meeting template
        (1) high areas
            (a) remove and waste all excess material
            (b) to match surrounding grade
        (2) low areas
            (a) fill and compact
            (b) to match surrounding grade
4. protect from frost
    a) use of chemicals not permitted

E. HANDLING, MEASURING AND BATCHING MATERIAL
1. Plant
    a) shall provide continuous supply of material
2. Stockpiles
    a) Construct and operate to prevent
        (1) segregation
        (2) introduction of deleterious materials
    b) Contaminated or segregated aggregates
        (1) shall not be used
    c) Aggregates
        (1) produced or handled by hydraulic methods, or
        (2) washed aggregates
            (a) bin or stockpile for drainage
                (i) at least 12 hours before being batched
        (3) aggregates shipped by rail
            (a) if transit time longer than 12 hours, cars must be free-draining
3. Batch plants
    a) shall be equipped to proportion aggregates and bulk cement by weight
        (1) using automatically interlocked proportioning devices
            (a) of an approved type
    b) if bulk cement used
        (1) use suitable method of handling
            (a) from weighing hopper to transporting container or batch
                (i) chute
                (ii) boot
                (iii) other approved method
            (b) to prevent loss of cement

(c) shall provide positive assurance that specified cement content is present in each batch

F. MIXING CONCRETE

1. Unless otherwise specified, mix concrete at:
   a) work site, or
   b) central mix plant, or
   c) truck mixers
   d) of approved type and capacity
   e) in accordance with ASTM C94
2. Mixing time
   a) measured from time all materials, except water are emptied into drum
3. Transport mixed concrete in
   a) truck mixers, or
   b) truck agitators, or
   c) non-agitating trucks
   d) time of transit
      (1) from addition of cementitious materials
      (2) to deposit of material on grade, shall not exceed
         (a) 30 minutes for non-agitating trucks
         (b) 90 minutes for truck mixers or truck agitators
   e) retempering by adding water or other means is not permitted
      (1) additional water and mixing permitted for transit mixers if
         (a) increase if slump required
         (b) addition made within 45 minutes after initial mixing
         (c) W/C does not exceed mix design
         (d) approved by Engineer

G. LIMITATIONS ON MIXING AND PLACING

1. Lighting conditions
   a) Do not mix, place or finish with insufficient natural light
      (1) unless artificial lighting system provided which is
         (a) adequate
         (b) approved by Engineer
2. Cold Weather
   a) discontinue mixing and concreting if temperature
      (1) is descending in the shade / away from heat source
      (2) reaches 40 deg F.
   b) resume when temperature
      (1) is ascending in shade / away from heat source
      (2) reaches 35 deg F
   c) before entering mixer aggregates shall
      (1) be free of ice, snow and frozen lumps
      (2) not be frozen
   d) concrete mix temperature
      (1) shall not be less than 50 deg F at time of placement
      (2) shall not be placed on frozen material
   e) if operating approved in cold weather
      (1) aggregates may be heated
         (a) to not more than 150 deg F
         (b) using apparatus that
            (i) heats mass uniformly
            (ii) can be arranged to preclude overheated areas
3. Hot Weather

a) take hot weather precautions
    (1) when maximum daily air temperature exceeds 85 deg F
b) sprinkle with water immediately before placing concrete
    (1) forms
    (2) underlying grade
c) place concrete at coolest temperature practicable
    (1) in no case should mix temperature exceed 90 deg F
    (2) to maintain mix temperature, cool as necessary
        (a) aggregates
        (b) mixing water
d) keep surface of newly laid pavement damp
    (1) by water-fog or mist
    (2) with approved spraying equipment
    (3) until covered by curing medium
e) protect concrete from evaporation rate > 0.2 psf per hour
    (1) as determined by
        (a) ACI 305R, Hot Weather Concreting
            (i) Figure 2.1.5 – which considers
                (a) relative humidity
                (b) wind velocity
                (c) air temperature
    (2) provide wind screens
f) if conditions indicate likelihood of plastic cracking
    (1) esp. if plastic cracking occurs
    (2) Contractor to take additional measures
        (a) wind screens
        (b) more effective fog sprays
        (c) similar measures
        (d) if not effective
            (i) paving operations shall be immediately stopped

4. Temperature Management Program
    a) Contractor to provide temperature management program
        (1) prior to start of paving
        (2) daily during concreting operations
        (3) to assure that uncontrolled cracking is avoided
    b) at a minimum to include:
        (1) Anticipated tensile strains
            (a) as related to heating and cooling of the concrete material.
        (2) Anticipated weather conditions including
            (a) ambient temperatures
            (b) wind velocity
            (c) relative humidity.
        (3) Anticipated timing of initial sawing of joint.

H. PLACING CONCRETE

1. General
    a) Unless otherwise specified, Contractor has option of placement
        (1) Side-form
        (2) Slip-form
    b) Free vertical drop of concrete
        (1) not to exceed 3 feet
    c) Horizontal movement or distribution of concrete from front of paver
        (1) shall not be done with

(a) backhoes
(b) grading equipment
(c) front-end loaders unless
(i) unless Contractor demonstrates
(a) concrete will not be contaminated
(b) base course will not be disturbed
(ii) approved by Engineer

d) Construction or other equipment on previously constructed pavement
(1) permitted when flexural strength of 550 psi is attained
(a) based on average of 4 field-cured specimens
(i) per 2,000 cu yds
(2) except that
(a) subgrade/subbase planers
(b) concrete pavers
(c) concrete finishing equipment
(d) all allowed on edges of previously constructed pavement when
(i) flexural strength of 400 psi is attained

2. Slip-form Construction
a) Distribute Uniformly with self-propelled slip-form paver
(1) alignment and elevation controlled from outside reference lines
(2) paver shall vibrate for full depth and width of placed material
(3) produce concrete which will
(a) stand normal to the surface
(b) with sharp, defined edges
(4) forms shall be rigidly held together laterally to prevent spreading of forms
b) Consolidate concrete with internal vibration
(1) definition internal vibration:
(a) units located within thickness of the pavement section
(2) full width transverse vibrating units, and/or
(a) @ uniform spacing $\leq$ 18 inches
(3) equally placed longitudinal units
(a) space from edge of pavement to unit $\leq$ 18 inches
(4) vibration of each vibrating unit
(a) frequency
(i) 8000 to 12, 000 cycles per minute
(ii) vary proportionally with rate of travel
(iii) measured by tachometer or other device
(b) amplitude
(i) sufficient to be visible at surface
(a) for at least one foot
(b) along entire length of vibrating unit
(c) shall provide uniform
(i) density
(ii) air content
c) Consistency
(1) concrete shall be held at uniform consistency
(2) maintain paver at nearly continuous forward motion
(a) coordinate mixing, delivering and spreading
(i) to minimize stopping and starting
(b) vibration shall be automatically stopped if forward motion stops
(c) no tractive force shall be applied to paver except as controlled by paver

d) Support of paver by adjacent pavement
(1) equipment shall have
(a) protective pads on crawler tracks, or
(b) rubber-tired wheels offset from edge
(i) far enough to avoid breakage

3. Side-form Construction
a) Forms shall be
(1) straight
(2) free from
(a) warps
(b) bends
(c) indentations
(d) other defects
(3) removed from site if defective
(4) metal
(a) except at
(i) end closures
(ii) transverse joints
(iii) where other materials may be used
(5) may be built up by rigidly attaching sections
(a) to top, or
(i) must also be metal
(b) to bottom
(c) if approved by Engineer
(6) dimensions
(a) width of base ≥ 80% of pavement thickness
(7) rigidity
(a) sufficient to prevent
(i) springing under weight of
(a) subgrading equipment
(b) paving equipment
(c) pressure of concrete
(8) number of forms sufficient
(a) to prevent daily in placing concrete
b) Condition of underlying surface prior to form placement
(1) shall be at
(a) proper grade
(b) proper alignment
(2) level to provide full bearing support for forms
(a) throughout length of form
(b) throughout wide of base
(3) able to firmly support the entire operation
(a) placing
(b) compacting
(c) finishing
c) Preparation of Forms
(1) shall be drilled in advance to accommodate dowels or tie bars
(2) true forms for line and grade
(a) immediately in advance of paver
(b) for a sufficient distance to prevent delays in placing concrete
d) After concrete placement
(1) forms remain for

(a) at least 12 hours
(b) until edge no longer needs protection
(2) apply curing compound
(a) immediately after removing forms
e) Reuse of Forms
(1) clean and oil each time
f) Placement of Concrete
(1) use one or more self-propelled machines
(a) to
(i) spread
(ii) screed
(iii) shape
(iv) consolidate
(b) provide adequate
(i) number and of machines
(ii) to match concrete delivery rate
(2) equipment shall uniformly
(a) distribute and consolidate material
(i) without segregation
(ii) conforming to required cross-section
(iii) with minimum of hand work
g) Consolidation of concrete
(1) consolidate with internal vibrators
(a) without segregation
(b) rate of vibration (minimum requirements)
(i) frequency $\geq$ 7,000 cycles per minute
(ii) amplitude sufficient
(a) perceptible on surface
(b) for more than 1 foot from vibrator
(c) equipped with tachometer to indicate frequency
(d) shall automatically stop when paver motion stops

4. Consolidation Testing
a) Vibrator requirements stated are minimum requirements
(1) to ensure adequate density in concrete
b) If Engineer suspects inadequate consolidation
(1) additional referee testing may be required
(a) determined by cores
(i) cut after minimum 24 hours
(ii) density based on water content
(iii) per ASTM C642
(a) saturated-surface dry condition
(b) minimum rate one core per 500 cu yds pavement
(i) or fraction thereof
(2) acceptable density – measured against original mix design density
(a) average density shall $\geq$ 97%
(b) no core shall have <96% density
(3) failing density tests
(a) evidence that vibration requirements are inadequate for mix
(b) provide means to increase consolidation to requirements
(i) additional vibration units
(ii) other means

I. STRIKE-OFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT

1. After placement, strike off to provide
    a) plan cross-section and elevation
        (1) after consolidation and finishing
2. For reinforced concrete placed in two layers
    a) place bottom layer
        (1) strike off to length and depth so as to allow
            (a) full length and depth placement of reinforcing steel
            (b) without further manipulation
        (2) place reinforcement directly on concrete
    b) place final layer concrete
        (1) strike off and screed
    c) remove and replace bottom layer if
        (1) more than 30 minutes has elapsed between placement of layers, or
        (2) if initial set of concrete has occurred
        (3) at Contractor's expense
3. For reinforced concrete placed in one layer
    a) position reinforcement in advance, or
    b) place in plastic concrete
        (1) by mechanical means, or
        (2) by vibratory means
4. Reinforcing steel
    a) shall be free of
        (1) mud
        (2) oil
        (3) other organic matter
    b) shall be satisfactory with
        (1) rust, or
        (2) mill scale, or
        (3) combination
        (4) provided hand-brushed specimen has satisfactory
            (a) minimum dimensions
            (b) weight
            (c) tensile properties

J. JOINTS
1. General
    a) Construct
        (1) as shown on plans and these requirements
        (2) faces perpendicular to
            (a) surface
            (b) finished edges
        (3) acceptable tolerances
            (a) position: +/- ½ inch
            (b) line and grade: ¼ inch in 10 ft
    b) Finish
        (1) test joints
            (a) before concrete hardens
            (b) with 10-ft straightedge
            (c) correct irregularities > ¼ inch
        (2) provide groove
            (a) uniform width and depth
            (b) as shown on plans
2. Construction Joints

a) Longitudinal Construction Joints
   (1) slip-formed, or
   (2) formed against side forms
   (3) as shown on plans
b) Transverse Construction Joints
   (1) install at end of each days placing operations
   (2) at other points when concrete placement interrupted
      (a) for more than 30 minutes, or
      (b) concrete appears to be obtaining initial set before next delivery
c) locate at planned construction or expansion joint
   (1) remove excess concrete back to previous planned joint

3. Contraction Joints
   a) install at locations and spacings shown on plans
   b) construct by
      (1) form groove in plastic concrete, or
         (a) use edging tool, or
            (i) sides shall be even and smooth
            (ii) to prevent spalling
         (b) insert material
            (i) install per manufacturer's instructions
      (2) sawcut groove in hardened concrete
      (3) groove shall be at least
         (a) 1/8 inch wide
         (b) to depth shown on plans
4. Expansion Joints
   a) install premolded filler as shown on plans
      (1) thickness as shown on plans
      (2) extend full depth and width of slab
         (a) except for sealant space at top
      (3) securely stake or fasten
         (a) perpendicular to FG
      (4) provide cap
         (a) to protect the top edge of the filler
         (b) to permit concrete placement and finishing
   b) after concrete placement and strike off
      (1) carefully withdraw cap
      (2) finish and tool edge of plastic concrete
      (3) remove concrete bridging joint space
         (a) for the full width and depth of joint

~~5. Keyways~~

6. Tie Bars
   a) install deformed bars as shown on plans
      (1) at right angles to centerline
      (2) spaced at intervals shown on plans
   b) hold in position horizontally
      (1) parallel to pavement surface
      (2) at middle of slab depth
   c) if bars extend into unpaved lane
      (1) bend against form at longitudinal construction joints
         (a) unless threaded bold are other assembled bars are specified
      (2) do not paint, grease, or enclose in sleeves
7. Dowel Bars

a) place across joints as shown on plans
b) shall be of dimensions and spacings shown on plans
c) hold rigidly
    (1) in middle of slab depth
    (2) at proper horizontal and vertical alignment
    (3) with approved assembly device
        (a) to be left in place
d) Install assembly as a unit
    (1) assembled and ready to be lifted into position
e) provide dowel expansion cap or sleeve
    (1) for each dowel bar used with expansion joints
    (2) caps shall:
        (a) be substantial enough to prevent collapse
        (b) placed on dowel ends as shown on plans
        (c) fit bar tightly
            (i) closed end shall be watertight
f) Apply debonding lubricant to painted portion of dowel (see II.G)
    (1) coat with
        (a) asphalt MC-70, or
        (b) approved lubricant
    (2) if free-sliding plastic or epoxy-coated dowels used
        (a) apply debonding lubricant
            (i) unless determined to be unnecessary
                (a) via approved pullout tests
    (3) for dowels in butt-type joints
        (a) oil exposed dowel end
~~g) Dowel bars at contraction joints~~
    ~~(1) may be placed in full thickness of pavement by mechanical device~~
        ~~(a) capable of producing required alignment tolerances~~
h) Dowel bars at longitudinal construction joints
    (1) shall be bonded in drilled holes

8. Installation
    a) All devices for installation of expansion joints
        (1) shall be approved by the Engineer
    b) Assembled joint device
        (1) set at proper distance below surface
            (a) check elevation
        (2) secure in place
            (a) with stakes
            (b) by other means
            (c) to maintain tolerances during concrete placement and finishing
    c) Premolded joint filler
        (1) maintain in vertical position
        (2) no offsets allowed between adjacent units
    d) Dowel bars and assemblies
        (1) check for position and alignment
            (a) per tolerances in V.B.8.g
        (2) place concrete directly on dowel assemblies immediately ahead of paver
            (a) to help maintain position and alignment
        (3) with slip-form paving
            (a) place dowels and tie bars by bonding into drilled holes
                (i) shall be 1/8” to ¼” larger diameter than dowel

(ii) drill with rotary drills
(a) held in position perpendicular to joint face
(b) rotary-percussion type acceptable if no spalling occurs
(i) damage to be repaired at Contractor's expense
(ii) method approved by Engineer
(iii) bond with epoxy resin
(a) inject into back of hole
(b) displace by insertion of dowel
(c) insert bar completely into hole
(i) do not withdraw or create air pocket

(4) Contractor to provide template to check dowel
(a) position
(b) alignment
(5) Place dowels
(a) not less than 10 inches from transverse joint
(b) so as to not interfere with transverse dowels

9. Sawing of Joints
a) cut as shown on plans
(1) use equipment per IV.A
(a) capable of cutting straight line groove
(i) at least 1/8 inch wide
(ii) to depth shown on plans
(2) widen top portion
(a) provide adequate space for sealers
(i) as shown on plans
b) commence sawcut as soon as
(1) concrete sufficiently hard
(a) to allow cutting without
(i) chipping
(ii) spalling
(iii) tearing
(2) before uncontrolled shrinkage cracking occurs
c) sawing shall be conducted
(1) during both day and night as necessary
(2) in same sequence as placement
(3) at required spacing
d) curing compound
(1) apply to sawcut
(a) except for faces to receive sealant
(2) maintain for remaining cure period
e) remove sawcut slurry
(1) by vacuuming and washing

K. FINAL STRIKE-OFF, CONSOLIDATION AND FINISHING
1. Sequence
a) sequence shall be
(1) strike off
(2) floating and removal of laitance
(3) straight edging
(4) final surface finish
b) adding water to assist finishing operations not permitted

2. Finishing at Joints
    a) compact concrete
        (1) without
            (a) voids
            (b) segregation
        (2) against joint material
        (3) under and around
            (a) load transfer devices
            (b) joint assembly units
            (c) other features extending into pavement
    b) adjacent to joints
        (1) mechanically vibrate per IV.H.2.b
        (2) operate finishing machine near joint
            (a) so as to avoid
                (i) damage
                (ii) misalignment
                (iii) segregation
            (b) if continuous operation of finisher causes joint damage
                (i) stop finishing equipment 8 inches from joint
                (ii) remove segregated concrete from joint
                (iii) resume forward motion
            (c) continuous operation over joints, without lifting screed, acceptable if:
                (i) no segregated concrete results between
                    (a) joint and
                    (b) screed or top of joint
3. Machine Finishing
    a) spread concrete as soon as placed
    b) strike off and screed with finishing machine
    c) repeat finishing as many times and at intervals required to
        (1) give proper consolidation
        (2) leave surface with uniform texture
    d) excessive operation to be avoided
    e) with side forms
        (1) keep tops of forms clean
            (a) by effective device attached to machine
            (b) to allow continuous travel of paver without
                (i) lift
                (ii) wobbling
                (iii) other variation to finish
        (2) during first pass of finisher
            (a) maintain uniform ridge of material ahead of screed
                (i) for entire length
        (3) while in operation
            (a) move with combined longitudinal and transverse shearing motion
            (b) always maintaining forward motion
            (c) without raising ends from side forms during strike-off
        (4) repeat finishing motion as necessary to produce
            (a) uniform texture
            (b) proper
                (i) grade

(ii) cross-section

4. Hand Finishing
   a) Not permitted except:
      (1) mechanical equipment breakdown
         (a) for material already deposited on grade only
      (2) areas of
         (a) narrow width
         (b) irregular dimensions
   b) use approved portable screed only
   c) provide second screed to strike off bottom layer for reinforced concrete
   d) portable screed shall be
      (1) at least 2 ft longer than maximum slab width
      (2) of approved design
      (3) sufficiently rigid to retain shape
      (4) constructed of
         (a) metal, or
         (b) other suitable material covered with metal
   e) consolidation shall be by suitable vibrators
5. Floating
   a) General
      (1) smooth and true
         (a) after consolidation
         (b) using longitudinal float
         (c) one of following methods
   b) Hand Method
      (1) long-handled floats
         (a) not less than 12 ft in length
         (b) not less than 6 inches wide
         (c) stiffened to prevent
            (i) flexibility
            (ii) warping
      (2) operate from foot bridge
         (a) supported at edge
         (b) spanning concrete
         (c) not touching concrete
      (3) pass float gradually
         (a) from one side to the other
         (b) forward motion along centerline
            (i) by successive advances of not more than ½ float length
         (c) remove and waste
            (i) excess water
            (ii) laitance
            (iii) in excess of 1/8 inch
   c) Mechanical Method
      (1) use machine composed of
         (a) cutting and smoothing floats
            (i) suspended from frame
            (ii) guided by frame
               (a) constantly in contact with
                  (i) side forms, or
                  (ii) underlying surface
      (2) long-handled floats may be used if necessary

(a) blades not less than
(i) 5 ft in length
(ii) 6 inches in width
(b) to smooth and fill in open-textured areas
(3) if crown precludes use of mechanical float
(a) float transversely with long-handled float
(b) use caution to avoid flattening crown
(4) remove and waste
(a) excess water
(b) laitance
(c) in excess of 1/8 inch
(5) successive drags may be overlapped
(a) ½ length of blade

6. Straight-Edge Testing and Surface Correction
a) test for trueness
(1) after strike-off
(2) while concrete still plastic
b) test with straightedge
(1) 16-foot
(2) Contractor-provided
(3) swung from handles
(a) 3 ft longer than ½ width of slab
(4) hold in contact with surface
(a) in successive positions
(b) parallel to centerline
(c) test full area of slab side-to-side
(d) advance in successive stages
(i) no more than ½ length of straightedge
c) remove and waste
(1) excess water
(2) laitance
(3) in excess of 1/8 inch
d) low areas
(1) fill immediately with fresh concrete
(2) strike-off
(3) consolidate
(4) refinish
e) high areas
(1) cut down
(2) refinish
f) special attention to ensure smoothness across joints
(1) must meet requirements of V.B.5.c
g) continue testing and surface corrections
(1) until entire surface
(a) free from observable departures from straightedge
(b) slab conforms to plan grade and cross-section
h) use of long-handled floats
(1) shall be confined to a minimum
(2) in areas not accessible to finishing equipment

L. SURFACE TEXTURE
1. General
a) Unless otherwise specified, shall be finished by brush, broom, burlap drag or

artificial turf
b) must not be unduly roughened
c) Contractor must correct texturing imperfections to satisfaction of Engineer

2. Brush or Broom Finish
   a) apply when water sheen has practically disappeared
   b) operate transversely
   c) provide corrugations approx 1/16 inch in depth
3. Burlap Drag Finish
   a) burlap weight at least 15 ounces per sq yd
   b) remove transverse threads for approx 1 ft from trailing edge
   c) allow heavy concrete buildup on threads to provide desired result
   d) corrugations shall be longitudinal striations
      (1) uniform in appearance
      (2) approx 1/16 inch in depth
4. Artificial Turf Finish
   a) drag surface in direction of concrete placement
   b) use approved full width artificial turf drag
   c) fasten leading transverse edge to lightweight pole on traveling bridge
   d) at least 2 ft of turf to be in contact with concrete
   e) variety of artificial turf types available
      (1) approval will be given only after field demonstration
      (2) one historically acceptable type
         (a) approx 7,200 0 polyethylene turf blades, 0.85” long, per square foot
   f) corrugations shall be
      (1) uniform in appearance
      (2) approx 1/16 inch in depth
5. Skid-Resistant Surfaces – Saw-Cut Grooving
   a) if required by plans, shall conform to Section 49 – Sawcut Grooves -P-621

M. CURING

1. General
   a) cure for 7-day period
   b) apply
      (1) immediately after finishing
      (2) as soon as marring will not occur
      (3) use one of approved methods, below
   c) operations will be immediately suspended if Contractor
      (1) fails to provide
         (a) sufficient curing material
         (b) in timely manner
         (c) adequate water
   d) do not leave concrete exposed
      (1) for more than ½ hour
      (2) throughout curing period
   e) joint sawcuts
      (1) if 2-cut sawcut method used:
         (a) apply curing method immediately after initial sawcut
         (b) do not sawcut sealant reservoir until curing period completed
      (2) if 1-cut sawcut method used:
         (a) cure with
            (i) wet rope, or
            (ii) wet rags, or

(iii) wet blankets
(b) keep moist for duration of curing period
f) set retardants (fly ash or chemical set retarders)
(1) may delay occurrence of bleed water
(2) apply curing after bleed water gone from surface

2. Impervious Membrane Method
a) spray entire surface
(1) with white pigmented curing compound
(2) immediately after the finishing
(3) before set of concrete
b) do not apply during rainfall
c) apply by pressurized mechanical sprayers
(1) fully atomizing type
(a) equipped with tank agitator
(b) material in fully mixed condition at time of application
(i) pigment uniformly dispersed throughout
(c) mixture to be stirred constantly
(i) by mechanical means
(ii) throughout application
(2) hand-spraying permitted
(a) when approved by Engineer
(b) for odd widths or shapes
(c) for concrete exposed by form removal
(3) @ 1 gal to not more than 150 sq ft
(a) double-application required for hand-sprayed areas
d) material shall form film within 30 minutes of application
(1) if film damaged within curing period by any cause, including sawcutting
(a) repair immediately
(i) with additional curing compound
(ii) or other approved means
e) upon removal of side forms
(1) apply curing treatment
(a) immediately
(b) equal to that provided for surface and sides of concrete

3. Polyethylene Films
a) cover entire surface with polyethylene sheeting
(1) lapped at least 18 inches
(2) place and weight to ensure constant contact with surface
(3) sheeting shall
(a) extend beyond pavement edge
(i) a distance equal to twice the thickness of pavement
b) maintain in place for 7 days
(1) unless otherwise specified
c) this method will be approved only for special applications

4. Waterproof Paper
a) cover top surfaces and sides with waterproof paper
(1) lapped at least 18 inches
(2) place and weight to ensure constant contact with surface
(3) sheeting shall
(a) extend beyond pavement edge
(i) a distance equal to twice the thickness of pavement
(4) fully saturate pavement surface prior to placing paper

b) maintain in place for 7 days
(1) unless otherwise specified
c) this method will be approved only for special applications

5. White Burlap-Polyethylene Sheets
a) cover entire surface with sheeting
b) sheeting shall
(1) extend beyond pavement edge
(a) a distance equal to twice the thickness of pavement
(2) cover surface and both edges
c) place and weight to maintain constant contact with surface
d) saturate and maintain for 7-day cure period
e) this method will be approved only for special applications

6. Water Method
a) cover entire surface with
(1) burlap, or
(2) other water absorbing material
b) material shall
(1) be of sufficient thickness
(a) to retain water
(b) without excessive runoff
c) maintain in wet condition for 7-day cure period
d) when forms stripped
(1) keep vertical walls moist
e) do not allow ponding of water on subbase
f) this method will be approved only for special applications

N. REMOVING FORMS
1. do not remove forms until concrete hardened sufficiently
a) to permit removal without
(1) chipping
(2) spalling
(3) tearing
2. cure sides of slabs by approved method per IV.M

O. SEALING JOINTS
1. Seal joints in accordance with Section 42 – Joint Filling Sealer

P. PROTECTION OF PAVEMENT
1. Protect pavement and appurtenances against all traffic
a) public
b) construction
2. Provide watchmen if required to
a) direct traffic
b) erect and maintain
(1) signs
(2) lights
(3) pavement bridges
(4) cross-overs
3. protect unsealed joints from foreign material
4. damage occurring prior to final acceptance
a) repaired, or
b) replaced
c) at Contractor's expense
5. Maintain on site
a) materials for protection of edges and surface, including

(1) rolled polyethylene sheeting
(a) at least 4 mils thick
(b) of sufficient length and width
(i) to cover slab and edges
b) mount sheeting on
(1) paver, or
(2) moveable bridge
(3) which permits unrolling
(a) without dragging over plastic concrete
c) if rain appears imminent
(1) stop paving operations
(2) all available personnel shall be assigned to unroll plastic

Q. OPENING TO TRAFFIC
1. Do not open to traffic until
a) flexural strength of 550 psi has been attained
(1) based on cores
(a) molded and cured per ASTM C31
(b) tested per ASTM C78
2. if tests not performed, open to construction traffic
a) after 14 days
b) after all joints
(1) have been sealed, or
(2) are protected from
(a) damage
(b) intrusion of foreign material
(c) minimum protection
(i) backer rod
(ii) backer tape
3. clean pavement prior to opening for normal operations

R. REPAIR, REMOVAL, REPLACEMENT OF SLABS
1. See Section 38 – Concrete Pavement Removal, Repair and Replacement

V. MATERIAL ACCEPTANCE

A. ACCEPTANCE SAMPLING AND TESTING
1. General
a) All testing for acceptance shall be done by the Engineer
(1) with the exception of coring for thickness determination
b) Concrete will be accepted on a lot basis
(1) Lot = 3,600 sq yds
c) Testing organizations
(1) shall conform to ASTM C1077
(a) including accreditation
(i) accreditation shall include ASTM C78
d) Testing facilities
(1) Contractor to provide
(a) curing facilities for strength specimens per V.A.2.c
(b) coring and filling operations per V.A.2.a
2. Flexural Strength
a) Sampling
(1) each lot divided into 4 equal sublots
(a) one sample per sublot to be taken from concrete delivered to jobsite

(b) sample locations shall be determined by procedures in ASTM D3665
(2) sample concrete in accordance with ASTM C172
b) Testing
(1) Two (2) specimens will be made from each sample
(a) make specimens per ASTM C31
(2) Test for flexural strength
(a) per ASTM C78
(b) Flexural strength computation
(i) flex strength of sublot = average of two test specimens from sublot
(3) Prior to testing
(a) determine sample unit weight
(i) weigh and measure beam
(a) measure at midpoint
(b) to nearest 0.1 inch
(ii) report weight to nearest 0.1 pound
(iii) unit weight = weight / calculated volume
(b) report unit weight as companion information to flexural strength
(4) transport specimens while still in molds
(5) cure by saturated lime immersion
(a) except for initial cure period
(6) Conduct for each set of strength samples - per ASTM C31:
(a) slump
(b) air content
(c) temperature
c) Curing
(1) Contractor shall provide curing facilities for initial curing of test beams
(2) First 24-hours after molding
(a) maintain temperature adjacent to molds at 60 – 80 deg F
(b) prevent loss of moisture
(c) store in
(i) tightly constructed wooden boxes, or
(ii) damp sandpits, or
(iii) temporary buildings, or
(iv) under wet burlap, or
(v) other suitable methods
(a) to provide temperature and moisture conditions
d) Acceptance
(1) will be determined per V.B.2

3. Pavement Thickness
a) Sampling
(1) Each lot divided into 4 equal sublots
(2) One core taken for each sublot
(a) location determined by Engineer
(i) per procedures in ASTM D 3665
(b) non-standard areas shall be excluded
(i) thickened edges
(ii) areas of variable thickness
(3) Contractor to cut with core drill
(a) furnish all labor, tools and materials

(i) to cut and fill sample cores

(4) Contractor to fill

(a) with non-shrink grout

(b) approved by the Engineer

(c) within one day of sampling

b) Testing

(1) Thickness determined by Engineer

(a) based on caliper measurements

(b) using procedures in ASTM C174

(2) Acceptance

(a) determined by Engineer

(b) per V.B.3

4. Partial Lots

a) Partial lots used

(1) if operational conditions cause lot to be terminated

(2) if agreed in writing between Contractor and Engineer

(a) for minor overages, or

(b) for minor placements

(c) use following procedure

b) Where 3 sublots have been produced

(1) they shall constitute a lot

c) Where 1 or 2 sublots have been produced

(1) they shall be incorporated into previous lot

(2) total number of sublots in acceptance criteria calculation shall be modified accordingly

5. Outliers

a) check all flexural strength test results for outliers

(1) procedures per ASTM C178

(a) @ significance level of 5%

b) discard outlier sample results

(1) base PWL on remaining test values

B. ACCEPTANCE CRITERIA

1. General

a) Acceptance will be based on

(1) Flexural strength

(2) Thickness

(3) Smoothness

(4) Grade

(5) Edge slump

(6) Dowel bar alignment

b) Acceptance on a lot basis for

(1) flexural strength

(2) thickness

(3) using Percentage within Specification Limits (PWL) method

(a) considers test result

(i) variability of the material (standard deviation)

(ii) mean value (average)

(b) calculates percentage of material above lower specification tolerance level (L)

c) Acceptance for

(1) flexural strength: acceptance criteria per V.B.5.a

(2) thickness: acceptance criteria per V.B.5.b

(3) smoothness: acceptance criteria per V.B.5.c
(4) grade: acceptance criteria per V.B.5.e

d) Engineer may reject batch of concrete material and require disposal
(1) which is rendered unfit due to
(a) contamination
(b) segregation
(c) improper slump
(2) notwithstanding any previous plant acceptance
(3) rejection may be based on only visual inspection
(4) Contractor may take representative sample in the presence of the Engineer
(a) if subsequent laboratory testing, in the presence of the Engineer, demonstrates that material was erroneously rejected
(i) will be paid at contract unit price

2. Flexural Strength
a) acceptance based on PWL
b) PWL shall be 90 or higher to be accepted
3. Pavement Thickness
(1) acceptance based on PWL
(2) PWL shall be 90 or higher to be accepted
4. Percentage of Material Within Limits (PWL)
a) PWL to be determined per Section 13 - Method of Determining Percentage Within Limits
b) Lower Specification Tolerance Limit (L)
(1) Flexural Strength: 0.93 × strength specified in paragraph III.A
(2) Thickness: Lot Plan Thickness in inches – 0.50 inches
5. Acceptance Criteria
a) Flexural Strength
(1) If PWL $\geq$ 90%., lot is acceptable
(2) Acceptance and payment per IX.A
b) Thickness
(1) If PWL $\geq$ 90%., lot is acceptable
(2) Acceptance and payment per IX.A
c) Smoothness
(1) After concrete hardened sufficiently, test with
(a) 16-ft straightedge, or
(b) other approved device
(2) Surface deviations shall not exceed ¼ inch in 16 feet
(a) straightedge placed in any direction
(b) including along and spanning joints
(3) High spots
(a) > ¼ inch but $\leq$ ½ inch
(i) mark and grind
(a) with approved grinding machine
(b) until within ¼-inch tolerance
(b) > ½ inch
(i) remove and replace pavement at Contractor's expense
d) [OPTIONAL: PROFILOGRAPH

NOTES TO ENGINEER: REQUIRES CASE-BY-CASE APPROVAL FROM FAA – RECOMMENDED ONLY FOR NEW CONSTRUCTION OR OVERLAYS DESIGNED TO CORRECT GRADE AND SMOOTHNESS DEFICIENCIES – IF ALLOWED

STRAIGHTEDGE REQUIREMENTS WILL APPLY ONLY IN TRANSVERSE DIRECTION – REPLACE PARAGRAPH C) ABOVE, WITH THE FOLLOWING IF PROFILOGRAPH IS TO BE ALLOWED

(1) After concrete hardened sufficiently, test in the transverse direction with
    (a) 16-ft straightedge, or
    (b) other approved device
(2) Surface deviations shall not exceed ¼ inch in 16 feet
    (a) straightedge placed in any direction
    (b) including along and spanning joints
(3) High spots
    (a) > ¼ inch but ≤ ½ inch
        (i) mark and grind
            (a) with approved grinding machine
            (b) until within ¼-inch tolerance
    (b) > ½ inch
        (i) remove and replace pavement at Contractor's expense
(4) In addition to 16-ft straightedge, Contractor to furnish 25-ft wheel base California-type profilograph
    (a) with competent operator
    (b) calibrate before testing
(5) operate per manufacturer's instructions
    (a) at speed ≤ 3 mph
    (b) maintain all original test measurements
(6) interpret profilographs per ASTM E 1274
    (a) at scale
        (i) 1"=25 ft longitudinally
        (ii) 1"=1" vertically
(7) test
    (a) for paving lanes greater than 20 ft wide
        (i) two passes along centerline of each paving lane greater than 20 ft wide
        (ii) each pass 6 ft from centerline of paving lane
        (iii) average of two passes = profilograph result for lane
    (b) for paving lanes less than 20 ft wide
        (i) one pass along centerline required
    (c) run test next working day after concrete placement
    (d) label each trace showing paving lane and stationing
    (e) provide to Engineer
(8) acceptance
    (a) pavement shall be constructed to provide average profile index
        (i) per IX.C
        (ii) subsection shall be
            (a) one paving lane width
            (b) 1/10 mile long
        (iii) Profile Index (PI) per ASTM E 1274
            (a) use blanking band 0.2 inches
    (b) within each subsection repair:
        (i) areas with > 0.4 inch deviation in 25 ft
            (a) grind with approved grinding device, or
            (b) device consisting of multiple diamond blades
            (c) use of bush-hammer or other impact device not permitted
    (c) after grinding may require further corrective action to correct

ride quality
(d) complete corrective work prior to thickness determination
(e) do second profilograph run after corrections made
(i) if average PI < 15, retest only areas with > 0.4 inch deviation
(f) payment adjustment for Profile Index
(i) if average PF < 10 inches per mile, payment will be made at contract unit price
(ii) see Table 4 for price adjustment when PF exceeds 10 inches per mile
(iii) if average is > 10 but < 15, Contractor may accept pay reduction per Table 4
(iv) areas with PI > 15 shall be removed and replaced at Contractor's expense

(9) Non-Standard Sections
(a) shorter than 50 ft
(b) last 15 ft of any section where contractor not responsible for adjoining section
(c) straightedge per V.B.5.c
(10) shorter than 250 ft
(a) include profilograph reading with previous section
(11) independent section 50 ft to 250 ft in length
(a) calculate pay factor per Table 4
(12) complete corrective work before
(a) joint sealing
(b) grooving
(13) All costs associated with profilograph shall be borne by Contractor]

e) Grade
(1) Evaluate grade as follows
(a) Lateral Deviation
(i) shall not exceed +/- 0.10 ft in any lane
(b) Vertical Deviation
(i) shall not exceed +/- 0.04 ft at any point
(2) Records shall be maintained showing all grade measurements

f) Edge Slump (for slip form paving)
(1) Definition: Free Edge
(a) cumulative linear measurement of pavement edge constructed as nonadjacent to existing pavement
(b) area affected by downward movement shall extend no more than 18 inches in from edge
(2) for each 500 ft pavement section
(a) not more than 15% of free edge shall exceed ¼ inch from plan
(b) none of free edge shall exceed 3/8 inch from plan
(c) if not corrected while concrete is plastic, slab shall be removed and replaced at Contractor's expense

g) Dowel Bar Alignment
(1) check for position and alignment
(2) maximum allowable tolerances
(a) alignment: 2% (or ¼ inch per foot of dowel bar)
(i) in both planes (horizontal and vertical)
(a) vertical alignment measure parallel to designed top surface

(i) except at crown or grade change joints
(ii) these measured relative to level surface

(b) horizontal alignment measure perpendicular to joint edge

(b) position tolerance from plans
(i) +/- 2 inches horizontal direction
(ii) +/- 3/8 inch vertical direction

6. Removal and Replacement of Concrete
   a) always remove back to planned joints
   b) dowel requirements for longitudinal construction joints in IV.J shall apply to all dowels exposed by concrete removal operations
   c) remove and replace per Section 38 – Concrete Removal, Repair and Replacement

VI. CONTRACTOR QUALITY CONTROL

A. QUALITY CONTROL PROGRAM

1. General
   a) develop Contractor Quality Control Program per Section 12 – Contractor Quality Control Program
   b) Include as a minimum:

(1) Mix Design
(2) Aggregate Gradation
(3) Quality of Materials
(4) Stockpile Management
(5) Proportioning
(6) Mixing and Transportation
(7) Placing and Consolidation
(8) Joints
(9) Dowel Placement and Alignment
(10) Flexural or Compressive Strength
(11) Finishing and Curing
(12) Surface Smoothness

NOTES TO ENGINEER: THIS REQUIREMENT MAY BE MODIFIED IF PROJECT < 600 SQ YDS

B. QUALITY CONTROL TESTING

1. General
   a) Contractor shall perform all tests necessary to control production and processes
      (1) as set forth in Section 12 – Contractor Quality Control Program (CQCP)
   b) Test shall include, as a minimum, tests for
      (1) aggregate gradation
      (2) aggregate moisture content
      (3) slump
      (4) air content
   c) Testing Plan shall be part of CQCP
2. Fine Aggregate
   a) Gradation
      (1) perform sieve analysis twice daily
      (2) per ASTM C136
      (3) from randomly sampled material taken from
         (a) discharge gate of storage bins, or

(b) conveyor belt

b) Moisture Content

(1) if electronic moisture meter used

(a) two direct moisture measurements per week shall also be taken for calibration

(2) if direct moisture tests made

(a) two direct moisture tests per day

(b) test per

(i) ASTM C70, or

(ii) ASTM C566

3. Coarse Aggregate

a) Gradation

(1) perform sieve analysis twice daily

(2) per ASTM C136

(3) from randomly sampled material taken from

(a) discharge gate of storage bins, or

(b) conveyor belt

b) Moisture Content

(1) if electronic moisture meter used

(a) two direct moisture measurements per week shall also be taken for calibration

(2) if direct moisture tests made

(a) two direct moisture tests per day

(b) test per ASTM C566

4. Slump

a) Four (4) slump tests for each lot produced

(1) lot size as defined in V.A

(2) one test for each sublot

b) test per ASTM C143

c) select random sampling locations from material discharged from trucks on grade

d) sample per ASTM C172

5. Air Content

a) Four (4) air content tests for each lot produced

(1) lot size as defined in V.A

(2) one test for each sublot

b) test per

(1) ASTM C231 for gravel or stone

(2) ASTM C173 for slag or porous aggregate

c) select random sampling locations from material discharged from trucks on grade

d) sample per ASTM C172

6. Unit Weight and Yield Tests

a) Four (4) unit weight and yield tests

(1) per ASTM C172

(2) at same time as air content tests

C. CONTROL CHARTS

1. General

a) Contractor shall maintain linear control charts for

(1) fine aggregate gradation

(2) coarse aggregate gradation

(3) slump

(4) air content

b) Post in location satisfactory to Engineer

c) Keep up to date at all times
d) As minimum show:
(1) project number
(2) contract item number
(3) test number
(4) each test parameter
(5) Action and suspension Limits, or
(6) Specification limits
(a) applicable to each test parameter
(7) Contractor's test results.
e) Contractor shall use charts as part of process control system
(1) to identify potential problems
(2) assign causes
(a) before they occur
f) If projected data indicates potential problem
(1) Contractor does not take satisfactory corrective action
(a) Engineer may
(i) halt production
(ii) reject placed material

2. Fine and Coarse Aggregate Gradation
a) record
(1) running average of last five gradation tests for each control sieve
(2) on linear control chart
(3) superimpose specification limits from Tables 1 and 2 onto chart for job control
3. Slump and Air Content
a) record
(1) individual measurements
(2) range (difference between high and low)
(3) plot Action and Suspension Limits per Table 3

TABLE 3. CONTROL CHART LIMITS

Control Parameter	Individual Measurements		Range Suspension Limit
	Action Limit	Suspension Limit	
Slip Form:			
Slump	+0 to -1 inch	+0.5 to -1.5 inch	+/- 1.5 inch
Air Content	+/- 1.2%	+/- 1.8%	+/- 2.5%
Fixed Form:			
Slump	+ 0.5 to -1 inch	+1 to -1.5 inch	+/- 1.5 inch
Air Content	+/- 1.2%	+/- 1.8%	+/- 2.5%

b) use mix design target values in individual measurement control charts as indicators of central tendency

D. CORRECTIVE ACTION
1. Contractor Quality Control Program shall indicate appropriate action when process is believed to be out of control
a) include what action is to be taken to bring process back into control
b) include set of rules to gauge when process out of control

2. process considered out of control, as a minimum, if:
    a) Fine and Coarse Aggregate Gradation
    b) When two consecutive averages of five tests are outside of the Tables 1 or 2 specification limits,
        (1) take immediate steps to correct grading,
            (a) including halting production
    c) Fine and Coarse Aggregate Moisture Content
        (1) Whenever moisture content of fine or coarse aggregate changes by more than 0.5 percent
            (a) adjust scale settings for
                (i) aggregate batcher(s) and
                (ii) water batcher
    d) Slump
        (1) halt production and make adjustments if:
            (a) one point falls outside the Suspension Limit line for individual measurements or range; or
            (b) two points in a row fall outside the Action Limit line for individual measurements.
    e) Air Content
        (1) halt production and adjust air-entraining admixtures if:
            (a) one point falls outside the Suspension Limit line for individual measurements or range; or
            (b) two points in a row fall outside the Action Limit line for individual measurements.
        (2) when point falls outside Action Limits line
            (a) calibrate admixture dispenser to ensure
                (i) accuracy
                (ii) good reproducibility

VII. SUBMITTAL REQUIREMENTS

A. AGGREGATE SUBMITTALS
B. OTHER MIX COMPONENTS
    1. Cement, Fly Ash, Admixtures
C. MIX DESIGN
D. LABORATORY CERTIFICATIONS
E. EQUIPMENT AND PLANT INFORMATION

VIII. METHOD OF MEASUREMENT

A. ____-INCH UNREINFORCED PCC PAVEMENT – PER SQ YD
    1. Measured by XX
    2. no separate measurement will be made in areas of variable thickness such as thickened edges
B. ____-INCH REINFORCED PCC PAVEMENT – PER SQ YD
    1. no separate measurement will be made in areas of variable thickness such as thickened edges

IX. BASIS OF PAYMENT

A. GENERAL
    1. Payment will be at contract unit price
    2. Adjusted in accordance with 501-8.1.a
        a) subject to limitation that
            (1) total payment for concrete pavement shall not exceed [ ] percent of product of

(a) contract unit price
(b) total number of sq yds of pavement accepted

NOTE TO ENGINEER: INSERT VALUE BETWEEN 100 AND 106 PERCENT. REVIEW WITH LAWA. AIP OR PFC FUNDS USED TO PAY EXCESS OF 100% MAY REQUIRE GRANT AMENDMENT.

B. BASIS OF ADJUSTED PAYMENT

1. Calculate Adjustment per Table 4
   a) calculate separate factor for
      (1) flexural strength
      (2) thickness
2. If both > 100
   a) Price Adjustment = higher of the two
3. If one greater and one less than 100
   a) Price Adjustment = product of two
4. If neither is greater than 100
   a) Price Adjust = lower of two

TABLE 4. PRICE ADJUSTMENT SCHEDULE[1]

Percentage of Material Within Specification Limits (PWL)	Lot Pay Factor (Percent of Contract Unit Price)
96 – 100	106
90 – 95	PWL + 10
75 – 90	0.5PWL + 55
55 – 74	1.4PWL – 12
Below 55	Reject [2]

5. Notes
   a) [1] Theoretically possible to achieve pay factor of 106%
      (1) Actual payment in excess of 100% subject to limitation in IX.A
   b) [2] Remove and replace lot
      (1) Engineer may allow to remain
         (a) Contractor and Engineer will agree in writing
            (i) pavement shall not be removed
            (ii) Contractor will be paid 50% of contract price
            (iii) total project limitation will be reduced by the amount so withheld
6. for each lot, accepted price is product of
   a) lot pay factor and
   b) contract unit price
7. payment in excess of 100% for accepted lots shall be used to offset payment for lots with pay factors less than 100%

C. [OPTIONAL IF PROFILOGRAPH IS USED FOR SMOOTHNESS ACCEPTANCE:

BASIS OF ADJUSTED PAYEMENT FOR SMOOTHNESS

1. Price shall be adjusted for smoothness in accordance with

a) the following equation, and
   (1) (Sq yds in section) x (original unit price per sq yds) x PFm = reduction in payment for area within section
b) Table 5:

TABLE 5 – PRICE ADJUSTMENT FOR SMOOTHNESS			
Average Profile Index (Inches per mile) PAVEMENT STRENGTH RATING			**CONTRACT UNIT PRICE ADJUSTMENT**
OVER 30,000#	30,000# OR LESS	SHORT SECTIONS	PFM
0 - 7	0 - 10	0 - 15	0.00
7.1 - 9	10.1 - 11	15.1 - 16	.0.02
9.1 - 11	11.1 - 12	16.1 - 17	0.04
11.1 - 13	12.1 - 13	17.1 - 18	0.06
13.1 - 14	13.1 - 14	18.1 - 20	0.08
14.1 - 15	14.1 - 15	20.1 - 22	0.10
15.1 & up	15.1 & up	22.1 & up	corrective work required

D. PAYMENT
1. Paid at contract unit price under Item Number
   a) 37.1 ____-INCH UNREINFORCED PCC PAVEMENT – PER SQ YD
   b) 37.2 ____-INCH REINFORCED PCC PAVEMENT – PER SQ YD
2. Payment is full compensation for all materials, labor, equipment, tools and incidentals.
3. No separate payment for work in areas of night or limited-time construction area

X. TESTING REQUIREMENTS

A. ASTM C 31 MAKING AND CURING CONCRETE TEST SPECIMENS IN THE FIELD

B. ASTM C 39 COMPRESSIVE STRENGTH OF CYLINDRICAL CONCRETE SPECIMENS

C. ASTM C 70 SURFACE MOISTURE IN FINE AGGREGATE

D. ASTM C 78 TEST FOR FLEXURAL STRENGTH OF CONCRETE (USING SIMPLE BEAM WITH THIRD-POINT LOADING)

E. ASTM C 88 TEST FOR SOUNDNESS OF AGGREGATES BY USE OF SODIUM SULFATE OR MAGNESIUM SULFATE

F. ASTM C 131 TEST FOR RESISTANCE TO ABRASION OF SMALL SIZE COARSE AGGREGATE BY USE OF THE LOS ANGELES MACHINE

G. ASTM C 136 SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES

H. ASTM C 138 TEST FOR DENSITY (UNIT WEIGHT), YIELD, AND AIR CONTENT (GRAVIMETRIC) OF CONCRETE

I. ASTM C 143 TEST FOR SLUMP OF HYDRAULIC CEMENT CONCRETE

J.	ASTM C 172	SAMPLING FRESHLY MIXED CONCRETE
K.	ASTM C 173	TEST FOR AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE VOLUMETRIC METHOD
L.	ASTM C 174	MEASURING THICKNESS OF CONCRETE ELEMENTS USING DRILLED CONCRETE CORES
M.	ASTM C 227	POTENTIAL ALKALI REACTIVITY OF CEMENT-AGGREGATE COMBINATIONS (MORTAR-BAR METHOD)
N.	ASTM C 231	TEST FOR AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE PRESSURE METHOD
O.	ASTM C 289	POTENTIAL ALKALI-SILICA REACTIVITY OF AGGREGATES (CHEMICAL METHOD)
P.	ASTM C 295	PETROGRAPHIC EXAMINATION OF AGGREGATES FOR CONCRETE
Q.	ASTM C 114	CHEMICAL ANALYSIS OF HYDRAULIC CEMENT
R.	ASTM C 535	TEST FOR RESISTANCE TO DEGRADATION OF LARGE-SIZE COARSE AGGREGATE BY ABRASION AND IMPACT IN THE LOS ANGELES MACHINE
S.	ASTM C 566	TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATES BY DRYING
T.	ASTM C 642	TEST FOR DENSITY, ABSORPTION, AND VOIDS IN HARDENED CONCRETE
U.	ASTM C 666	RESISTANCE OF CONCRETE TO RAPID FREEZING AND THAWING
V.	ASTM C 1077	STANDARD PRACTICE FOR LABORATORIES TESTING CONCRETE AND CONCRETE AGGREGATES FOR USE IN CONSTRUCTION AND CRITERIA FOR LABORATORY EVALUATION
W.	ASTM C 1260	POTENTIAL ALKALI REACTIVITY OF AGGREGATES (MORTAR-BAR METHOD)
X.	ASTM D 3665	RANDOM SAMPLING OF PAVING MATERIALS
Y.	ASTM D 4791	TEST METHOD FOR FLAT OR ELONGATED PARTICLES IN COARSE AGGREGATE
Z.	ASTM E 178	DEALING WITH OUTLYING OBSERVATIONS
AA.	ASTM E 1274	TEST FOR MEASURING PAVEMENT ROUGHNESS USING A PROFILOGRAPH
BB.	AASHTO T 26	QUALITY OF WATER TO BE USED IN CONCRETE

XI. MATERIAL REQUIREMENTS

A.	ASTM A 184	SPECIFICATION FOR FABRICATED DEFORMED STEEL BAR MATS FOR CONCRETE REINFORCEMENT

B.	ASTM A 185	SPECIFICATION FOR STEEL WELDED WIRE FABRIC, PLAIN, FOR CONCRETE REINFORCEMENT
C.	ASTM A 497	SPECIFICATION FOR STEEL WELDED WIRE FABRIC, DEFORMED, FOR CONCRETE REINFORCEMENT
D.	ASTM A 615	SPECIFICATION FOR DEFORMED AND PLAIN BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT
E.	ASTM A 704	SPECIFICATION FOR WELDED STEEL PLAIN BAR OR ROD MATS FOR CONCRETE REINFORCEMENT
F.	ASTM A 714	SPECIFICATION FOR HIGH-STRENGTH LOW-ALLOY WELDED AND SEAMLESS STEEL PIPE
G.	ASTM A 996	SPECIFICATION FOR RAIL-STEEL AND AXLE STEEL DEFORMED BARS FOR CONCRETE REINFORCEMENT
H.	ASTM C 33	SPECIFICATION FOR CONCRETE AGGREGATES
I.	ASTM C 94	SPECIFICATION FOR READY-MIXED CONCRETE
J.	ASTM C 150	SPECIFICATION FOR PORTLAND CEMENT
K.	ASTM C 171	SPECIFICATION FOR SHEET MATERIALS FOR CURING CONCRETE
L.	ASTM C 260	SPECIFICATION FOR AIR-ENTRAINING ADMIXTURES FOR CONCRETE
M.	ASTM C 309	SPECIFICATION FOR LIQUID MEMBRANE-FORMING COMPOUNDS FOR CURING CONCRETE
N.	ASTM C 494	SPECIFICATION FOR CHEMICAL ADMIXTURES FOR CONCRETE
O.	ASTM C 595	SPECIFICATION FOR BLENDED HYDRAULIC CEMENTS
P.	ASTM C 618	SPECIFICATION FOR COAL FLY ASH AND RAW OR CALCINED NATURAL POZZOLAN FOR USE AS A MINERAL ADMIXTURE IN CONCRETE
Q.	ASTM C 881	SPECIFICATION FOR EPOXY-RESIN BASE BONDING SYSTEM FOR CONCRETE
R.	ASTM C 989	SPECIFICATION FOR GROUND GRANULATED BLAST-FURNACE SLAG FOR USE IN CONCRETE AND MORTARS
S.	ASTM D 1751	SPECIFICATION FOR PREFORMED EXPANSION JOINT FILLER FOR CONCRETE PAVING AND STRUCTURAL CONSTRUCTION (NONEXTRUDING AND RESILIENT BITUMINOUS TYPES)
T.	ASTM D 1752	SPECIFICATION FOR PREFORMED SPONGE RUBBER AND CORK EXPANSION JOINT FILLERS FOR CONCRETE PAVING AND STRUCTURAL CONSTRUCTION
U.	ACI 305R	HOT WEATHER CONCRETING

V. ACI 306R COLD WEATHER CONCRETING

W. ACI 309 GUIDE FOR CONSOLIDATION OF CONCRETE

X. MIL-DTL-24441/2(1999)

PAINT, EPOXY-POLYAMIDE, GREEN PRIMER, FORMULA 150, TYPE III
DEPARTMENT OF DEFENSE

XII. END OF SECTION

SECTION 38 – CONCRETE REPAIR, REMOVAL AND REPLACEMENT

38-1 GENERAL

38-1.1 Description

This specification covers the repair of concrete pavement, constructed under Section 37 of these Specifications, which is found to be damaged or defective. Such pavement, under the terms of Section 37, is required to be removed and replaced at the cost of the Contractor. At the discretion of the Engineer, however, certain types of damage or defect may be repaired at the Contractor's expense, and, if the repair is found to be acceptable, the concrete pavement will be accepted, subject to any adjusted payment stipulations which may apply under Paragraph 501-8.1 of Section 37.

This following specification addresses these situations, and gives the requirements relative to effecting such repairs. In addition, this specification sets forth the requirements for full slab removal. No additional payment will be made for any repairs or slab replacement made under this section. The Engineer maintains the right to ultimately require complete removal and replacement of the defective slab should he find that the repairs undertaken are unacceptable. Nothing in this specification obligates the Engineer to accept the Contractor's request to attempt repair of damaged or defective pavement in lieu of full slab removal and replacement as required by Section 37, although such approval will not be withheld arbitrarily.

New pavement slabs that are broken or contain cracks shall be removed and replaced or repaired, as specified herein, at the Contractor's expense. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. The Engineer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be 4-inch diameter, shall be drilled by the Contractor, and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes shall be at the Contractor's expense.

38-1.2 Identification. Prior to commencing repair work on the concrete pavement, the Contractor, in the company of the Engineer, shall inspect the concrete to identify defects and mark any areas that shall be repaired. Identification of defects approved for attempted repair shall be at the sole discretion of the Engineer.

38-2 MATERIALS

38-2.1 Elastomeric Concrete. Spall repair material shall be an elastomeric concrete consisting of a fluid base or binder with suitable reinforcing agents to provide a product which mixes in five minutes or less, flows readily, strongly, adheres to concrete, requires no external application of heat for curing and cures within one hour of application.

This material shall be "DelPatch™" as manufactured by the D.S. Brown Company, or approved equal.

A. Properties. The material-shall meet the properties in Table 1:

TABLE 1

Properties	Requirement	Test Method
Tensile Strength	600 psi, min	ASTM D 412 (Mod)
Elongation at break	25 %, min	ASTM D 412 (Mod)
Hardness, Type D Durometer	50 pts, min	ASTM D2240
Compression-Deflection Properties		
Stress (psi) 5% Deflection	800 min/1400 max	D 695
Resilience, 5% Deflection	95 min	D 695 (Mod)
Impact Ball Drop @ -20°F	>10 ft	D 3029 (Mod)
Adhesion to Concrete (psi)		
Dry Bond	400 min	
Wet Bond	250 min	

B. Application. Spall repair materials shall be weighed and mixed in accordance with the manufacturer's recommendations. The material shall be placed into the area to be repaired in layers up to finished grade within four minutes of the initial mixing. The material shall be allowed to cure two hours before opening to construction traffic.

[C. Manufacturer's Representative. A representative or agent of the manufacturer shall be present during the initial uses of this product to satisfy himself and the Engineer that it is being properly applied.]

38-2.2 High Molecular Weight Methylmethacrylate (HWHM). HWHM for filling hairline and low severity cracks shall be 4R by 3 M, T70X by Transpo, Pronto by SIKA, or approved equal.

38-2.3 Epoxy Resin. All epoxy resin used for crack repair shall conform to ASTM C 881, Type IV, of the various grades specified.

38-2.4 Other Materials. Unless otherwise specified herein, materials used for concrete pavement repair shall conform to the material requirements set forth in Section 37 of these Specifications, Portland Cement Concrete Pavements (FAA P-501).

38-3 TESTING AND QUALITY CONTROL

Unless otherwise specified herein, quality control testing and evaluation required for repair of concrete pavement shall conform to the testing requirements set forth in Section 37 of these Specifications, Portland Cement Concrete Pavements (FAA P-501). All costs for testing associated with effecting repairs under this section shall be borne solely by the Contractor.

38-4 REPAIR OF CRACKS

38-4.1 Cracks That Do Not Exceed 4 Inches in Depth. Except as otherwise specified below, cracks less than 4 inches deep (including plastic shrinkage cracks) shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved. Care shall be taken to assure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the Engineer.

Where routing is specified, routing shall be done with a vertical spindle router or a concrete saw with a small diameter blade. Rotary impact routers shall not be used. Cracks shall be pressure-washed to remove all loose debris and cement mortar. Cracks shall be routed to a minimum width of 1/2-inch and 3/4-inch depth. When routing must be wider to match the crack width, the depth shall equal the width. When backer rod material is required, the depth shall be increased to accommodate the backer rod.

Guidelines for crack repair follow:

A. Low severity cracks. Isolated hairline cracks and cracks to 1/16 inch shall be filled with High Molecular Weight Methylmethacrylate (HMWM) filler. Application shall be in accordance with the manufacturer's recommendations. Low severity cracks with spalling shall be routed and sealed with epoxy resin.

B. Cracks from 1/16-inch to 1/8-inch wide shall be routed and sealed with epoxy resin.

C. Cracks over 1/8-inch in width shall require removal and replacement of the slab.

38-4.2 Cracks Greater than 4 Inches in Depth.

A. Slabs with Cracks through Interior Areas. Interior area is defined as that area more than 6 inches from any designed joint location. Slabs with any cracks greater than 4 inches deep that extend into the interior area, regardless of direction, shall be removed and replaced at the Contractor's expense.

B. Cracks Close to and Parallel to Joints. All cracks essentially parallel to original joints, extending deeper than 4 inches, and lying wholly within 6 inches on either side of the joint shall be treated as specified in the following subparagraphs. Any crack extending more than 6 inches from the joint shall be treated as specified above in subparagraph a, above, "Slabs With Cracks Through Interior Area."

Any cracks which do not extend 4 inches deep shall be treated as specified above in subparagraph 38-4.1.

(1) Cracks Greater Than 4-inches in Depth Present, Original Joint Not Opened. When the original uncracked joint has not opened, the crack shall be routed and sealed, and the original joint filled with epoxy resin as specified below. The crack shall be routed with an easily guided, wheel mounted, vertical shaft, powered rotary router designed so the routing spindle will caster as it moves along the crack. The reservoir for joint sealant in the crack shall be formed by routing to a depth of 3/4 inch, plus or minus 1/16 inch, and to a width of 1/2 inch, plus or minus 1/8 inch. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent such raveling or spalling.

The joint sealant shall be a liquid sealant as specified in Section 37. Installation of joint seal shall be as specified for sealing joints or as directed. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures. If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler type material has been used to form a weakened plane in the joint, it shall be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures.

Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remainder of the width, it shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

(2) Cracks Greater Than 4-inches in Depth Present, Original Joint Also Cracked. At a joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab containing the crack shall be removed and replaced for the full lane width and length.

38-5 PARTIAL DEPTH SPALL REPAIR OF PAVEMENT

Spall repair shall consist of sawing concrete behind the spalled area, removing concrete pavement to expose sound pavement throughout the repair area, preparing and installing repair material, and completion of the sawn joint.

38-5.1 Establishing Repair Boundaries. The limits of the unsound concrete shall be determined by sounding with a steel rod. The rod shall be dropped from a height of 4 to 6 inches. The sounding will produce a dull sound in areas of delaminated concrete. A sharp ringing sound will be heard when there is sound concrete. The repair boundary which shall be outside the unsound concrete, a minimum of three inches into sound concrete. Concrete to be removed shall be sawcut in a rectangular pattern, square to the slab edges, with rounded corners.

38-5.2 Cutting the Repair Limits. Corners of repair limits shall be drilled to a minimum depth of 2 inches using 4-inch or larger diameter core drills. Diamond blade sawcuts shall then be made along the tangents of these cores, square to the slab edges, to establish the removal area. The depth of sawcut shall be a minimum of 2 inches. When the boundaries of multiple partial depth repairs areas are closer than 24 inches, the repair areas shall be combined as one repair. Where repairs abut previously sealed joints, a sawcut of minimum depth shall be made along the joint face to remove old joint sealant and to make a clean vertical face at the joint.

38-5.3 Removal of Existing Concrete. Existing concrete within the boundaries of the repair shall be removed by chipping with pneumatic tools. Pavement breakers or hydraulic rams shall not be used. Concrete will be removed to the depth of the sawcut or to at least ½ inch beyond sound concrete, whichever is deeper. The depth of total removal shall be at least 3 inches. Sounding within the limits of the repair will ensure that all damaged and unsound concrete has been removed. When the depth of the unsound concrete exceeds one-half of the slab depth, the slab will be removed and replaced. Under no circumstances will a partial depth repair be allowed to rest on a dowel bar.

38-5.4 Preparation of Cavity

The cavity thus formed shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. The concrete surface preparation and patch installation shall be accomplished in accordance with the material manufacturer's recommendations. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens

38-5.5 Placement of Filler. An insert or other bond-breaking medium shall be used to prevent bond at the joint face and to shape a reservoir for the joint sealant. The cavity shall be filled with elastomeric concrete, except that any spall less than 0.1 cu. ft. shall be repaired with epoxy resin mortar or a Grade III epoxy resin. Elastomeric concrete shall be proportioned, mixed, placed, consolidated, and cured as directed by the manufacturer and approved by the Engineer. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved by the Engineer. The epoxy resin materials shall be placed in the cavity in layers not over 2 inches thick. The time interval between placement of additional layers shall be such that the temperature of the epoxy resin material does not exceed 140°F (60°C) at any time during hardening. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens.

38-6 FULL DEPTH REPAIRS

Full depth slab repairs will not be allowed. Where spall repair extends more than one-half the slab depth, the entire slab shall be removed and replaced at the Contractor's expense.

38-7 REMOVAL AND REPLACEMENT OF FULL SLABS

Where it is necessary to remove full slabs, unless there are keys or dowels present, all edges of the slab shall be cut full depth with a concrete saw. All saw cuts shall be perpendicular to the slab surface. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 24 inches from the edge if only keys are present, or just beyond the end of the dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 1 inch of the depth of the dowel or key.

The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along keyed or doweled edges shall be carefully broken up and removed using light, hand-held jackhammers, 30 pounds or less, or other approved similar equipment. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. The joint face below keys or dowels shall be suitably trimmed so that there is not abrupt offset in any direction greater than 1/2 inch and no gradual offset greater than 1 inch when tested in a horizontal direction with a 12 foot straightedge. No mechanical impact breakers, other than the above hand-held equipment shall be used for any removal of slabs. If underbreak between 1-1/2 and 4 inches deep occurs at any point along any edge, the area shall be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary. If underbreak over 4 inches deep occurs, the entire slab containing the underbreak shall be removed and replaced.

Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified. Original damaged dowels or tie bars shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All four edges of the new slab shall contain dowels. Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material (unless it is stabilized) shall be recompacted and shaped as specified in the appropriate section of these Specifications. The surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker.

If sawcutting extends into joints between existing slabs to remain, the existing joint treatment (expansion material and sealant) shall be restored. If sawcuts extend into the concrete of existing slabs that are otherwise intended to remain, these slabs shall be completely replaced by the Contractor, at no cost to the Owner.

When a slab is replaced, new dowels shall be installed on joints as detailed for the original construction. On doweled joints with existing slabs, the new dowels will be offset horizontally from the original positions. The holes drilled in adjacent slabs for the new dowels shall be at the midpoints between the halves of the dowels remaining from the original construction. The spacing of new dowels from the slab corners shall be determined by the Engineer.

Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material shall be recompacted and shaped as specified in the appropriate section of these specifications, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels. The resulting joints around the new slab shall be prepared and scaled as specified for original construction.

38-8 REPAIR AND CORRECTION OF SURFACE DEFICIENCIES

38-8.1 High Areas. High areas of concrete surfaces shall be reduced either by rubbing the freshly finished concrete with carborundum brick or by grinding of the hardened concrete. Grinding will not be done until the concrete is at least 36 hours old. High areas in subgrade or base course shall be trimmed and the area scarified and compacted.

38-8.2 Thickness Deficiency. When the measurements of the concrete surface are deficient by more than ½ inch, the deficient layer will be removed and replaced.

38-9 REPAIR OF CONCRETE QUALITY DEFICIENCY

38-9.1 Slump and Air Content. See Section 37 of these Specifications.

38-9.2 Strength Deficiency. See Section 37 of these Specifications.

38-9.3 Smoothness. See Section 37 of these Specifications.

38-10 ACCEPTANCE

If the Engineer considers the repairs to be unacceptable under any criteria described herein, or that the repaired slab is not of commensurate quality to that of concrete pavement in Section 37 of these specifications, the Engineer may require complete removal and replacement of the slab at the Contractor's sole expense.

38-11 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

No measurement for payment will be made for any repairs effected under this Specification. If the Engineer elects to accept the repaired pavement, it will be measured and paid under Section 37. Nothing in this specification obligates the Engineer to accept the Contractor's request to repair damage or deficiencies in place of full slab removal and replacement, however. See

Section 38-12 for penalty assessment which will apply to each repaired spall or slab requiring repair under this section.

Full slab removal, as part of demolition operations, will be measured and paid under Section 14 of these specifications.

38-12 PENALTY

Any deficiencies that must be corrected during construction will result in future maintenance costs that will be borne by the Engineer. Therefore, the Contractor will be assessed a penalty of Five Hundred ($500) dollars for each spall repaired, over and above the cost to repair the spall. This penalty will be deducted by the Engineer from the funds otherwise due the Contractor.

END OF SECTION 38

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. GENERAL

A. DESCRIPTION – THIS SECTION COVERS

1. Repair of new pavement found to be damaged or defective.
   a) In lieu of removal and replacement as required by Section 37-Portland Cement Concrete Pavement
   b) Repair attempt only if approved by the Engineer.
      (1) If repair acceptable,
         (a) no separate payment will be made for repairs
         (b) payment will be made for repaired pavement under Sections
            (i) Section 37 – Portland Cement Concrete Pavement
            (ii) this section
               (a) with penalties applied
      (2) If unacceptable, remove and replace entire slab
2. Full slab removal for:
   a) new slabs
      (1) no payment will be made
   b) existing slabs
      (1) payment will be made under Section 14-Removals
3. Engineer not required to accept attempt to repair new damaged or defective pavement
   a) Such approval will not be withheld arbitrarily
4. All work to be done in accordance with the plans and specifications.

B. IDENTIFICATION

1. Contractor, in company of Engineer, will identify defects
   a) Mark for repair
2. Areas marked shall be at sole discretion of Engineer

II. MATERIALS

A. ELASTOMERIC CONCRETE

1. General
   a) Fluid base with reinforcing agents
   b) mix in 5 minutes or less
   c) flows readily
   d) strongly adheres to concrete
   e) requires no external application of heat
2. Properties
   a) "DelPatch" or approved equal
      (1) must conform to Table 1:

TABLE 1 – ELASTOMERIC CONCRETE PROPERTIES

Properties	Requirement	Test Method
Tensile Strength	600 psi, min	ASTM D 412 (Mod)
Elongation at break	25 %, min	ASTM D 412 (Mod)
Hardness, Type D Durometer	50 pts, min	ASTM D2240
Compression-Deflection Properties		
Stress (psi) 5% Deflection	800 min/1400 max	D 695
Resilience, 5% Deflection	95 min	D 695 (Mod)

TABLE 1 – ELASTOMERIC CONCRETE PROPERTIES		
Properties	**Requirement**	**Test Method**
Impact Ball Drop @ -20°F	>10 ft	D 3029 (Mod)
Adhesion to Concrete (psi)		
Dry Bond	400 min	
Wet Bond	250 min	

3. Application
   a) weigh and mix per manufacturer's recommendations
   b) place in layers up to finished grade
      (1) within 4 minutes of initial mixing
   c) cure 2 hours minimum before opening to traffic
4. [OPTIONAL: Manufacturer's Representative
   a) If requested by Engineer, manufacturer's rep shall be present during initial stages of placement
      (1) to ensure that material is properly applied.]

B. HIGH MOLECULAR WEIGHT METHYLMETHACRYLATE (HWHM)
1. 4R by 3 M, or
2. T70X by Transpo, or
3. approved equal

C. EPOXY RESIN
1. Conform to ASTM C881, of type and grade specified
   a) Type III
      (1) Grade
         (a) as specified herein
         (b) contingent upon particular use
   b) Type IV
      (1) Grade
         (a) as specified herein
         (b) contingent upon particular use

D. OTHER MATERIALS
1. Conform to like materials from Section 37 – Portland Cement Concrete Pavement

III. TESTING AND QUALITY CONTROL

1. As required in Section 37 – Portland Cement Concrete Pavement
2. Cost to be borne by Contractor

IV. CONSTRUCTION METHODS

A. REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS
1. General
   a) new slabs to be removed, replaced or repaired:
      (1) broken
      (2) containing cracks
      (3) at Contractor's expense
   b) spalls along joints
      (1) repair as specified herein
   c) removal of partial slabs not permitted
   d) removal and replacement shall be
      (1) full depth
      (2) full width
      (3) limit of removal normal to
         (a) paving lane
         (b) original transverse joint

e) determination of full depth cracks
(1) by the Engineer by full depth cores
(2) 4" diameter cores
(a) drilled by Contractor
(b) Contractor fill with well-consolidated concrete mix
(c) bonded with epoxy resin
(i) ASTM C881, Type V
(d) at Contractor's expense

2. Shrinkage Cracks
a) Definition
(1) less than 4 inches in depth
(2) Severity
(a) Low Severity
(i) isolated hairline cracks
(ii) ≤ 1/16 inch wide
(b) Medium Severity
(i) 1/16 inch to 1/8 inch wide
(c) High Severity
(i) >1/8 inch wide
b) Repair
(1) low severity shrinkage cracks
(a) fill with High Molecular Weight Methylmethacrylate (HMWM) filler
(b) apply per manufacturer's recommendations
(2) medium severity shrinkage cracks
(a) clean
(b) pressure inject with epoxy resin
(i) Type IV, Grade 1
(ii) use approved procedures
(c) insure that crack is not widened during injection
(d) injection shall be done in the presence of Engineer
(3) high severity shrinkage cracks
(a) remove and replace slab
c) cracks deeper than 4 inches to be repaired per IV.A.3 or IV.A.4

3. Slabs With Full Depth (> 4 inches) Cracks Through Interior Areas
a) Definition Interior Area:
(1) more than 6 inches from either transverse or longitudinal joint
b) Remove and replace full slab
(1) at Contractor's expense

4. Slabs with Full Depth (> 4 inches) Cracks Close To And Parallel With Joints
(1)
(2) essentially parallel to original joint
(3) within 6 inches of original joint
(a) if > 6 inches treat as interior joint crack per IV.A.3.
b) Repair
(1) Full depth crack – original joint not opened
(a) saw and seal crack
(i) rout with equipment especially designed to follow random cracks
(ii) form reservoir
(a) depth: ¾ inch (+/- 1/16 inch)
(b) width: 5/8 inch (+/- 1/8 inch)

(iii) replace/ modify equipment/procedures
(a) if raveling occur
(b) if spalling occurs
(iv) seal with joint sealant specified, or
(a) per Sections
(i) 37 – Portland Cement Concrete
(ii) 42 – Joint Sealing Filler
(b) as directed by Engineer
(b) Fill original joint
(i) if original joint reservoir has been sawcut
(a) fill reservoir and lower sawcut with
(i) epoxy resin Type IV, Grade 2
(ii) thoroughly tool into void
(iii) using approved procedures
(ii) if only lower sawcut has been completed
(a) clean
(b) pressure inject
(i) epoxy resin Type IV, Grade 1
(ii) using approved procedures
(iii) if filler material used to form original joint
(a) completely saw out filler material
(b) pressure inject
(i) epoxy resin Type IV, Grade 1
(ii) using approved procedures
(c) Parallel crack runs part way across slab, then intersects original joint
(i) treat cracked portion per IV.A.4.b.1
(ii) treat original joint portion as originally designed
(2) Full depth crack – original joint also cracked
(a) remove and replace entire slab
(i) applies if <u>any</u> portion of joint is in this condition

5. Removal and Replacement of Full Slabs
a) If no dowels present
(1) sawcut all edges full depth
(a) with concrete saw
(b) perpendicular to slab surface
b) If dowels present
(1) sawcut full depth
(a) just beyond edge of dowels
(2) then sawcut on the joint line
(a) within 1 inch of depth of dowel
c) Further divide slab by sawcutting
(1) full depth
(2) at appropriate locations
(3) do additional sawcuts as necessary to provide for vertical lift out of pieces
(a) using approved equipment to attachment to slab pieces
d) carefully break up and remove concrete along joint line
(1) use light, hand-held jackhammers
(a) 30 lb or less, or
(b) other approved equipment
e) Prevent damage to dowels and concrete to remain
(1) trim joint faces below dowels

(a) reduce
(i) abrupt offset to < ½ inch in all directions
(ii) gradual offset to < 1 inch
(iii) when tested in horizontal direction
(a) using 12-ft straightedge

f) Do not use mechanical impact breakers
(1) except for handheld per IV.A.5 d.

g) If underbreak occurs along any edge
(1) between 1-1/2 inch and 4 inches
(a) repair as directed by Engineer before replacing slab
(i) use procedures similar to spall repair
(a) modified as necessary
(2) greater than 4 inches
(a) remove and replace slab containing underbreak

h) Dowels or tie bars
(1) Where no dowels exist on damaged edge
(a) install dowels of similar size and spacing per project plans
(i) drill holes
(ii) install dowels with epoxy grouting
(a) per Section 37 – Portland Cement Concrete Pavement
(2) Damaged existing dowels or tie bars
(a) cut off flush with joint face
(3) Protruding dowels
(a) paint and lightly oil
(4) All four edges of new slab shall contain dowels

i) Placement of concrete
(1) as originally specified per Section 37 – Portland Cement Concrete Pavement
(a) underlying course
(i) shape, scarify, and recompact underlying unbound course
(b) joint faces
(i) clean all four joint faces of loose material
(ii) coat with double application of membrane forming curing compound
(a) prevent contact with dowels or tie bars
(c) joints
(i) seal per original construction plans
(a) Section 37 – Portland Cement Concrete Pavement
(b) Section 42 – Joint Sealing Filler

6. Repairing Spalls Along Joints
a) Establish limits of repair
(1) by sounding concrete with steel rod
(a) drop from height of 4-6 inches
(b) dull sound => unsound concrete
(c) ringing sound=> sound concrete
(2) repair boundary shall be at least 3 inches outside unsound concrete

b) Make vertical sawcut
(1) Cut rounded corners of repair with approximately 4-inch diameter coring equipment

(a) at least ~~1~~ 3 inches outside spalled area
(b) to depth of at least 2 inches
(2) connect with straight sawcut lines
(a) connecting corner tangents
(b) to depth of at least 2 inches
(3) chip out concrete between sawcut and joint
(a) at least ½ inch into visually sound concrete

c) Clean and prepare cavity
(1) high pressure water jets and
(2) compressed air
(3) prime coat contact surfaces
(a) except joint face
(b) epoxy resin Type III, Grade 1
(c) apply thin coat
(i) scrub into surface with stiff-bristle brush
(ii) avoid pooling of epoxy
(4) to abutting joint faces apply
(a) approved bond breaker, or
(b) joint insert

d) Preparation of filler
(1) portland cement materials
(a) proportion, mix, place, consolidate and cure as directed
(2) epoxy resin mortars
(a) use Type III, Grade 1
(b) proportion, mix, place, consolidate and cure
(i) as recommended by manufacturer
(ii) as approved by the Engineer

e) Fill cavity
(1) low slump cement-based filler, or
(a) concrete, or
(b) mortar
(2) epoxy resin-based filler
(a) concrete (elastomeric concrete), or
(b) mortar
(3) appropriate material based on size of spall
(a) > 0.5 cu. ft
(i) use concrete
(b) 0.1 – 0.5 cut ft
(i) use mortar
(c) < 0.1 cu ft
(i) use epoxy resin mortar, or
(ii) use epoxy resin Type III
(4) Epoxy Resin materials
(a) place in layers $\leq$ 2 inches thick
(b) time interval for placement of subsequent layers
(i) such that temperature does not exceed 140 deg F at any time
(5) Consolidate concrete or mortar
(a) use mechanical vibrators or hand tampers
(6) Remove excess materials from surrounding surfaces before it hardens

f) Complete joint
(1) sawcut reservoir

(a) equipment and methods per Section 37 – Portland Cement Concrete, or
(b) as for routed cracks Section IV.A.4.b.1.a
(2) clean reservoir
(3) seal reservoir per Sections 37 and 42
g) If spall depth exceeds ½ slab thickness
(1) remove and replace slab

B. REMOVAL AND REPAIR OF EXISTING CONCRETE PAVEMENT
1. General
a) control all operations to prevent damage to remaining
(1) adjacent slabs
(2) underlying courses
b) make all sawcuts perpendicular to slab surface
2. Removal of Existing Pavement Slab
a) remove per IV.A.5
3. Edge Repair
a) General
(1) protect existing concrete at all times
(2) if damage cause by Contractor operations
(a) repair at Contractor's expense
(3) if damage pre-existing
(a) payment will be by bid item herein, or
(b) will be considered incidental
b) Spall Repair
(1) Repair of pre-existing spalls
(a) where indicated on the plans
(b) where directed by Engineer
(c) using procedures in IV.A.6
c) Underbreak Repair
(1) Repair all underbreak
(2) Procedures
(a) remove delaminated and loose material
(b) recompact underlying material without addition of new material
(c) thoroughly moisten underlying material
(d) completely fill void with paving concrete
(e) completely consolidate concrete
(f) produce even joint face from top to bottom
(g) coat with curing compound
(i) in amount approved by the Engineer
d) Underlying Material
(1) protect from damage or disturbance during slab removal operations
(2) shape as shown on drawings or as directed by Engineer
(3) provide adequate material outside joint line to prevent sloughing from under pavement to remain
(4) If disturbed
(a) remove and replace with concrete per IV.B.3.c.

V. ACCEPTANCE

A. Acceptance of repaired pavement at sole discretion of the Engineer

VI. PENALTY

A. Repaired deficiencies will increase maintenance costs to Owner.
B. Contractor will be assessed penalty of $500 for each spall repaired.

VII. SUBMITTAL REQUIREMENTS

A. ELASTOMERIC CONCRETE
B. HWHM
C. EPOXY RESIN
D. OTHER REPAIR MATERIALS

VIII. METHOD OF MEASUREMENT

A. Unless otherwise specified, no measurement for payment for work under this section.
B. Accepted pavement will be measured and paid under section 37 – portland cement concrete pavement.
C. Engineer not obligated to accept request to repair damaged or defective pavement
   1. Removal and replacement may be required.
D. All work under this Section done at Contractor's expense.
E. See penalty charges for spall or slab repairs in VI.
F. Slab removal as part of demolition operations to be measured and paid under Section 14 – Removals.
G. [OPTIONAL: Repair of pre-existing concrete spalls in existing concrete will be measured for payment by the cubic foot of repaired spalls, as measured after the cavity has been cleaned and approved by the Engineer.]

IX. BASIS OF PAYMENT

A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
   1. [OPTIONAL: 38.1 Concrete Spall Repair of Existing Pavement – per cu ft
   2. Is full compensation for all materials, labor, equipment, tools and incidentals.
   3. No separate payment for work in areas of night or limited-time construction area.]

X. END OF SECTION

SECTION 62 – BITUMINOUS PRIME COAT (FAA P-602)

39-1 GENERAL

The Contractor shall provide bituminous prime coat on unbound base layers prior to paving with asphalt surface course. Application of bituminous prime coat shall be in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-602, as included and modified hereafter. Prime coat shall be required on compacted aggregate base course prior to paving bituminous concrete.

ITEM P-602 BITUMINOUS PRIME COAT

DESCRIPTION

602-1.1 *This item shall consist of an application of bituminous material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.*

MATERIALS

602-2.1 BITUMINOUS MATERIAL. *The types, grades, controlling specifications, and application temperatures for the bituminous materials are given in Table 1. The Engineer shall designate the specific material to be used.*

TABLE 1. BITUMINOUS MATERIAL

Type and Grade	*Specification*	*Application Temperatures (° F)*
Emulsified Asphalt		
SS-1, SS-1h	*ASTM D 977*	*70-160*

CONSTRUCTION METHODS

602-3.1 WEATHER LIMITATIONS. *The prime coat shall be applied only when the existing surface is dry or contains sufficient moisture to get uniform distribution of the bituminous material, when the atmospheric temperature is above 60°F (15°C), and when the weather is not foggy or rainy. The temperature requirements may be waived, but only when so directed by the Engineer.*

602-3.2 EQUIPMENT. *The equipment used by the Contractor shall include a self-powered pressure bituminous material distributor and equipment for heating bituminous material.*

The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

If the distributor is not equipped with an operable quick shut off valve, the prime operations shall be started and stopped on building power. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the owner.

A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

602-3.3 APPLICATION OF BITUMINOUS MATERIAL. *Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material.*

The bituminous material including solvent shall be uniformly applied with a bituminous distributor at the rate of 0.25 to 0.50 gallons per square yard depending on the base course surface texture. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

Following the application, the primed surface shall be allowed to dry not less than 48 hours without being disturbed or for such additional time as may be necessary to permit the drying out of the prime coat until it will not be picked up by traffic or equipment. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the surfacing has been placed. Suitable precautions shall be taken by the Contractor to protect the primed surface against damage during this interval, including supplying and spreading any sand necessary to blot up excess bituminous material.

602-3.4 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY. *Samples of the bituminous materials that the Contractor proposes to use, together with a statement as to their source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous materials to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials, so demonstrated by service tests, shall be acceptable.*

The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The test reports shall contain all the data required by the applicable specification. If the Contractor applies the prime material prior to receipt of the tests reports, payment for the material shall be withheld until they are received. If the material does not pass the specifications it shall be replaced at the contractor's expense. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

602-3.5 FREIGHT AND WEIGH BILLS. *Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer.*

Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

METHOD OF MEASUREMENT

602-4.1 *See Section 39-2.*

BASIS OF PAYMENT

602-5.1 *See Section 39-3.*

MATERIAL REQUIREMENTS

ASTM D 977	*Emulsified Asphalt*

TESTING REQUIREMENTS

ASTM D 1250	*Petroleum Measurement Tables*
Asphalt Institute	*Asphalt Pocketbook of Useful Information*
Manual MS-6 Table IV-3	*(Temperature-Volume Corrections for Emulsified Asphalts)*

END OF ITEM P-602

39-2 METHOD OF MEASUREMENT

The bituminous material for prime coat will not be measured for payment but is considered incidental to asphalt concrete pavement

39-3 BASIS OF PAYMENT

Bituminous Prime Coat are considered incidental to asphalt pavement, and no separate payment will be made.

END OF SECTION 39

SECTION 40 – BITUMINOUS TACK COAT

40-1 GENERAL

The Contractor shall perform all work required by the plans for application of bituminous tack coat in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-603, as included and modified hereafter, and as shown on the Plans or as directed by the Engineer.

Tack coat shall be required prior to paving bituminous concrete on concrete or asphalt, and on underlying lifts of multiple-lift asphalt paving. Both horizontal and vertical faces shall be tacked.

ITEM P-603 BITUMINOUS TACK COAT

DESCRIPTION

603-1.1 *This item shall consist of preparing and treating a bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.*

MATERIALS

603-2.1 BITUMINOUS MATERIALS. *The bituminous material shall be either cutback asphalt, emulsified asphalt, or tar and shall conform to the requirements of Table 1. The type, grade, controlling specification, and application temperature of bituminous material to be used shall be specified by the Engineer.*

Table 1
BITUMINOUS MATERIAL

		Application Temperature	
Type and Grade	***Specification***	***Deg. F***	***Deg. C***
Paving Asphalt	*AASHTO M320*		
Same grade as pavement being tacked		*285-347*	*140-175*
Emulsified Asphalt			
SS-1, SS-1h	*ASTM D 977*	*75-130*	*25-55*

CONSTRUCTION METHODS

603-3.1 WEATHER LIMITATIONS. *The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 60°F (15°C). The temperature requirements may be waived, but only when so directed by the Engineer.*

603-3.2 EQUIPMENT. *The Contractor shall provide equipment for heating and applying the bituminous material.*

The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

If the distributor is not equipped with an operable quick shut off valve, the tack operations shall be started and stopped on building paper. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the owner.

A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

603-3.3 APPLICATION OF BITUMINOUS MATERIAL. *Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or airblast to remove all loose dirt and other objectionable material.*

Emulsified asphalt shall be diluted by the addition of water when directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.

The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate of 0.05 to 0.15 gallons per square yard depending on the condition of the existing surface. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

603-3.4 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY. *Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.*

The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The tests reports shall contain all the data required by the applicable specification. If the Contractor applies the material prior to receipt of the tests reports, payment for the material shall be withheld until they are received. If the material does not pass the specifications it shall be replaced at the contractor's expense. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.

603-3.5 FREIGHT AND WEIGH BILLS. *Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer. Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.*

METHOD OF MEASUREMENT

603-4.1 *See Section 40-2.*

BASIS OF PAYMENT

603-5.1 *See Section 40-3.*

MATERIAL REQUIREMENTS

ASTM D 633	*Volume Correction Table for Road Tar*
ASTM D 977	*Emulsified Asphalt*
ASTM D 1250	*Petroleum Measurement Tables*
ASTM D 2028	*Cutback Asphalt (Rapid-Curing Type)*
ASTM D 2397	*Cationic Emulsified Asphalt*
Asphalt Institute Manual MS-6 Table IV-3	*Asphalt Pocketbook of Useful Information (Temperature-Volume Corrections for Emulsified Asphalts)*

END ITEM P-603

40-2 METHOD OF MEASUREMENT

The bituminous material for tack coat will not be measured for payment.

40-3 BASIS OF PAYMENT

Bituminous Tack Coat is considered incidental to other bid items, and no separate payment will be made.

END OF SECTION 40

SECTION 42 – JOINT SEALING FILLER (FAA P-605)

42-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of Portland cement (PCC) and asphalt (AC) pavement joints in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-605, as included and modified hereafter, and as shown on the Plans. If pre-molded joint sealer is proposed for PCC pavement joints, it shall conform to the requirements set forth in Section 37 of these Specifications.

ITEM P-605 JOINT SEALING FILLER

DESCRIPTION

605-1.1 *This item shall consist of providing and installing a resilient and adhesive joint sealing filler capable of effectively sealing joints and cracks in pavements.*

MATERIALS

605-2.1 JOINT SEALERS. *Joint sealing material shall conform to FAA Specification Item P-605. It shall be specifically designed for use in sealing joints in concrete and asphalt pavement. Sealant shall conform to Federal Specification S-00230C, Type 1, Class A, and ASTM C920, Type S, Grade P, Class 25. Test results from a certified laboratory shall confirm that submitted alternates have the following properties:*

(a) *Color: Grey.*

(b) *Service Range: Minus 40 to 170 degrees F.*

(c) *Curing Rate: Tack Free 1-2 hours, final cure 3-5 days.*

(d) *Recovery: Greater than 90 percent.*

(e) *Shore "A" Hardness (ASTM D2240) 21-Day: 45.*

(f) *Tensile Properties (ASTM D412):*

1) *Tensile Strength: 550 psi.*

2) *Elongation at Break: 700 percent.*

3) *Modulus of Elasticity 100 Percent: 150 psi.*

(g) *Adhesion Peel (ASTM C794) (Substrate Concrete):*

1) *Peel Strength: Greater than 30 psi.*

2) *Adhesion Loss: 0 percent.*

(h) *Joint Movement: Plus or minus 25 percent.*

Each lot or batch of sealing compound shall be delivered to the job site in the manufacturer's original sealed bulk drums and with manufacturer's certification stating that the compound meets requirements specified.

Contractor shall store sealing materials from inclement weather and maintain material temperatures as recommended by manufacturer. Store sealers as required by applicable materials specifications.

605-2.2 BACKER ROD. *Preformed backer rod shall be installed in all pavement construction, expansion, and contraction joints as shown in the Plans. Rods shall be approved, non-moisture absorbing, non-gassing, extruded closed-cell polyethylene foam of reticulated closed cell extruded polyolefin foam. Backer rods shall be of a sufficient diameter to support the sealant in the joint until it has cured. Backer rod materials shall be compatible with the sealant, shall not adhere to the sealant, shall be compressible without extruding the sealant, and shall recover to maintain contact with the joint faces when the joint is open.*

CONSTRUCTION METHODS

605-3.1 TIME OF APPLICATION. *Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be above 40°F (4°C) at the time of installation of the poured joint sealing material.*

605-3.2 PREPARATION OF JOINTS.

a. Sawing*. All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary.*

b. Sealing*. Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, and other foreign material. Cleaning shall be accomplished by sandblasting. Sandblasting shall be accomplished in a minimum of two passes. One pass per joint face with the nozzle held at an angle directly toward the joint face and not more that 3 inches from it. Upon completion of cleaning, the joints shall be blown out with compressed air free of oil and water. Only air compressors with operable oil and*

water traps shall be used to prepare the joints for sealing. The joint faces shall be surface dry when the seal is applied.

Prior to resealing joints, the existing joint material shall be removed to the depth as shown on the Plans. If joint sealer other than that originally used is specified, all existing joint sealer shall be removed.

605-3.3 INSTALLATION OF SEALANTS. *Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer before sealing is allowed. Sealants shall be installed in accordance with the following requirements:*

Cold Applied Sealants. Cold applied joint sealing compound shall be applied by means of pressure equipment that will force the sealing material to the bottom of the joint and completely fill the joint without spilling the material on the surface of the pavement. A backing material shall be placed as shown on the plans and shall be nonadhesive to the concrete or the sealant material. Sealant that does not bond to the concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition will be rejected and replaced by the Contractor at no additional cost. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing, mixing, and placing the sealant will produce a satisfactory joint seal. This shall include the preparation of two small batches and the application of the resulting material. Any sealant spilled on the surface of the pavement, structures and/or lighting fixtures, shall be removed immediately.

a. *Unless otherwise specified, seal joints as soon as feasible after completion of curing period and before pavement is opened to traffic, including construction equipment.*

    1) *Do not apply joint sealing compound in wet joints, when atmospheric and pavement temperatures are below 50 degrees F, or when weather is rainy or foggy.*

b. *Immediately before sealing, sandblast joints to remove laitance, curing compound, and other foreign material.*

    1) *Remove laitance, curing compound, and other foreign materials from upper edges of joint to distance not less than 1 inch from each side of joint edge on pavement surface.*

    2) *Sand shall be of proper size and quality necessary for Work.*

    3) *Nozzle shall be of proper size and of long-wearing type. Nozzles enlarged by wear shall be replaced as necessary.*

4) *Sandblast at air pressure or not less than 90 psi using minimum of 300 cubic feet of air per minute.*

c. *Following sandblasting, clean joints using air blowing nozzle.*

1) *Air compressors shall be portable and capable of furnishing not less than 90 pounds per square inch pressure.*

2) *Employ suitable traps to maintain compressed air free of oil and free of moisture. Presence of oil or free moisture in compressed air will necessitate cessation of operations until suitable adjustments are made.*

d. *Remove foreign material and other debris from joints or cracks from pavement surface by means of power sweeper or hand broom and immediately remove from designated area.*

1) *Remove debris before beginning joint sealing operation.*

2) *Remove sandblasting residue from joint.*

3) *Remove sealant spilled on surface of pavement immediately.*

e. *Under no circumstances shall liquid membrane curing compound be applied in joints.*

f. *Use curing tape, backer rod, or approved bond-breakers as shown on the Plans at expansion joints to isolate joint filler from joint seal.*

g. *Fill joint with continuous body of sealing compound free of voids, blisters, and foreign particles. Top of compound shall be 1/8- to 1/4-inch from top surface of pavement, unless otherwise detailed on the Plans. Excess sealer on surface of pavement shall be removed and surface left in clean condition.*

h. *Seal all cracks in existing asphalt prior to installing the asphalt overlay. No direct payment will be made as the sealing will be considered an incidental.*

METHOD OF MEASUREMENT

605-4.1 *See Section 42.2.*

BASIS OF PAYMENT

605-5.1 *See Section 42-3.*

TESTING REQUIREMENTS

ASTM D 412 *Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension*

ASTM D 1644 Test Methods for Nonvolatile Content of Varnishes

MATERIAL REQUIREMENTS

ASTM D 1854 Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Applied Elastic Type

ASTM D 3406 Joint Sealants, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements

ASTM D 3569 *Joint Sealant, Hot-Applied, Elastometric, Jet-Fuel-Resistant Type, for Portland Cement Concrete Pavements*

ASTM D 3581 Joint Sealant, Hot-Applied, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements

ASTM D 5893 Standard Specifications for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

ASTM D 6690 Joint and Crack Sealants, Hot-Applied, for Concrete and Asphalt Pavements

FED SPEC SS-S-200E(2)
Sealants, Joint, Two-Component, Jet-Blast Resistant, Cold Applied

END ITEM P-605

42-2 METHOD OF MEASUREMENT

No separate measurement of joint sealing filler as described herein shall be made.

42-3 BASIS OF PAYMENT

No separate payment will be made for joint sealing filler, which cost is considered incidental to associated bid items.

END OF SECTION 42

SECTION 47 - GEOTEXTILES

47- 1 GENERAL

This item covers the furnishing of all materials, equipment, labor and supervision necessary to install geotextile fabrics, of the types indicated, at the locations indicated on the plans or as directed by the Engineer.

47- 2 MATERIAL

47-2.1 Filter Fabric

Fabric shall conform to Section 88-1.03 of the State of California Standard Specifications with the following additional requirements:

A. The 85 percent size of the underlying material, divided by the nearest opening size of Apparent Opening Size (AOS) sieve (nearest U.S. Standard Sieve) of the fabric shall be equal to or greater than one.

B. Open area shall not to exceed 36 percent.

To reduce the chance of clogging, no cloth should be used with an open area less than 4 percent, or an AOS with openings smaller than the openings of a U.S. Standard Sieve Sized 150 micrometers No. 100.

When appropriate for the soil conditions, filter fabric shall be Mirafi 140NC, or approved equal.

47-2.2 Subgrade Stabilization Geotextile

The use of geotextiles for subgrade stabilization under pavement construction is anticipated on the job, although specific locations, types and quantities will, by necessity, have to be field-determined. To provide for isolated instability problems in subgrade excavations under pavement, a quantity of subgrade stabilization geotextile, of two types, has been included in the bid, and the Contractor will be expected to maintain an adequate amount of each on site for such eventualities. In addition, adequate quantities of biaxial geogrid is required for the construction of bioswale ditches at the locations shown on the plans.

Either of the following materials will be acceptable for pavement subgrade stabilization. For bioswale ditch construction, biaxial geogrid as described in paragraph B, below, is required.

A. Subgrade Stabilization Fabric shall be a woven or non-woven engineering geosynthetic, specially designed for subgrade separation and support, conforming to the requirements in Section 213-2 of the Standard Specifications.

B. Geogrid shall be Tensar Geogrid BX-1200, or approved equal. Reinforcement shall be a biaxially oriented geogrid with high tensile modulus in relation to the material being reinforced; with large apertures; thick ribs and continuity of tensile strength through all ribs of the structure. The geogrid shall maintain its reinforcement and interlock under normal construction practices, and shall be resistant to both ultraviolet degradation and all forms of biological degradation normally encountered in the material being reinforced. The geogrid shall be a single-layer grid that meets the dimensions and properties outlined below. Multi-layered grids fastened together shall not be acceptable. The biaxial geogrids shall also conform, in all respects, to the property requirements listed in Table 1:

TABLE 1

PROPERTY	TEST METHOD	UNITS	VALUE
Tensile			
Peak Tensile MD[1]	GRI GG1	lb/ft	1200 (min)
Tensile @ 2% MD	GRI GG1	lb/ft	410 (min)
Tensile @ 5% MD	GRI GG1	lb/ft	810 (min)
Peak Tensile CMD[1]	GRI GG1	lb/ft	1970 (min)
Tensile @ 2% CMD	GRI GG1	lb/ft	600 (min)
Tensile @ 5% CMD	GRI GG1	lb/ft	1320 (min)
Modulus @ 2% Strain	GRI GG1[2]	lb/ft	18,500 (min)
Apertures			
MD dimensions	I.D. Calipered	in	1.0 (nom)
CMD dimensions	I.D. Calipered	in	1.3 (nom)
open area	COE Method Modified[3]	%	70 (min)
Junctions[4]			
Thickness	O.D. Calipered	in	0.16 (nom)
Efficiency	GRI GG2	%	90 (min)
Strength	GRI GG2	lb/ft	1080 (min)
Secant Aperture	Grid Aperture Test	cm-kg/deg	6.50

Notes:

1) MD - Machine Direction which is along roll length.
   CMD - Cross Machine Direction which is across roll width.
2) Secant Modulus at 2% elongation measured by Geosynthetic Research Institute Test Method GG1 – 1987 "Geogrid Tensile Strength." No offset allowances are made in calculating Secant Modulus.

3) Percent open area measured without magnification by Corps of Engineers method as specified in CW 02215 Civil Works Construction Guide, November 1977.
4) The value of the Peak Tensile Strength times Junction Efficiency shall be greater than 756 lb/ft..
5) Grid Aperture Stability Test developed by Dr. T. Kinney at the University of Alaska, Fairbanks.

47- 3 CONSTRUCTION METHODS

Upon exposure of unstable subgrade materials, and when it is determined by the Engineer to be necessary, subgrade stabilization geotextile, either fabric or geogrid, shall be placed at the locations directed by the Engineer. The Contractor will place the geotextile in accordance with the manufacturer's recommendations, or in conformance with Section 300-10 of the Standard Specifications, whichever is more stringent. The material will then be backfilled with an adequate depth of sound aggregate or PMB, and compacted as required to provide a stable construction platform so that pavement construction can continue. The Contractor shall conform to the geotextile manufacturer's recommendations regarding overlap, pinning, backfill and other construction methods.

47- 4 METHOD OF MEASUREMENT

The quantity of geotextile to be measured for payment shall be the number of square yards of material of the type indicated (filter fabric, subgrade stabilization fabric or geogrid) placed and accepted by the Engineer. Measurement will be made in place. Overlap will not be measured for payment.

[Geotextiles will not be measured for payment but will be considered incidental to the item for which they are required.]

47- 5 BASIS OF PAYMENT

Payment shall be made at the contract unit price per square yard for "Filter Fabric", which price shall be full compensation for providing and installing this item, and for all labor, supervision, equipment, tools, and incidentals necessary to complete the item.

Payment shall be made at the contract unit price per square yard for "Subgrade Stabilization Fabric", which price shall be full compensation for providing and installing this item, and for all labor, supervision, equipment, tools, and incidentals necessary to complete the item.

Payment shall be made at the contract unit price per square yard for "Geogrid", which price shall be full compensation for providing and installing this item, and for all labor, supervision, equipment, tools, and incidentals necessary to complete the item.

[No payment will be made for geotextiles which will be considered incidental to the bid items for which they are required.]

No additional payment will be made for difficulties encountered when installing geotextile fabric in areas of night construction, or in other areas subject to construction phasing restrictions.

Payment will be made under:

[Item 47.1 Filter Fabric.....per square yard]

[Item 47.2 Subgrade Stabilization Fabric.....per square yard]

[Item 47.3 Geogrid .....per square yard]

END OF SECTION 47

SECTION 49 – SAW-CUT GROOVES (FAA P-621)

49-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of sawcut grooves in asphalt or portland cement concrete pavement in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-621 as included and modified hereafter, and as shown on the Plans.

ITEM P-621 SAW-CUT GROOVES

DESCRIPTION

621-1.1 *This item consists of providing a skid resistant surface that prevents hydroplaning during wet weather in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer.*

CONSTRUCTION METHODS

621-2.0 *Grooving must occur within 24 hours of any milling or planing activities.*

621-2.1 *Transverse grooves saw-cut in the pavement must form a 1/4 inch wide by 1/4 inch deep by 1 1/2 inches center-to-center configuration. The grooves must be continuous for the entire runway length. They must be saw-cut transversely in the runway pavement to not less than 10 feet from the runway pavement edge to allow adequate space for equipment operation. The Contractor must provide a grooving machine of a type equipped with diamond-saw cutting blade groove cutting head capable of making at least 18 inches in width of multiple parallel grooves in one pass of the machine. Thickness of the cutting blades shall be capable of making the required width and depth of grooves in one pass of the machine. The cutting head shall not contain a mixture of new and worn blades or blades of unequal wear or diameter. The wheels on the grooving machine shall be of a design that will not scar or spall the pavement. The machine must be equipped with devices to control depth of groove and alignment within the specified tolerances.*

621-2.2 Tolerances.

The saw-cut grooves must meet the following tolerances. The tolerances apply to each day's production and to each piece of grooving equipment used for production. The Contractor is responsible for all controls and process adjustments necessary to meet these tolerances.

A. Alignment tolerance: *Plus or minus 1-1/2 inches in alignment for 75 feet.*

B. Groove tolerance:

***1. Depth**. The standard depth is 1/4 inch. At least 90 percent of the grooves must be at least 3/16 inch, at least 60 percent of the grooves must be at least 1/4 inch, and not more than 10 percent of the grooves may exceed 5/16 inch.*

***2. Width**. The standard width is 1/4 inch. At least 90 percent of the grooves must be at least 3/16 inch, at least 60 percent of the grooves must be at least 1/4 inch, and not more than 10 percent of the grooves may exceed 5/16 inch.*

***C. Center-to -center spacing.** The standard spacing is 1-1/2 inches. Allowed tolerance:*

1. Minimum spacing 1-3/8 inches.
2. Maximum spacing 1-1/2 inches.

Saw-cut grooves must not be closer than 3 inches or more than 9 inches from transverse paving joints. Grooves must not be closer than 6 inches and no more than 18 inches from in-pavement light fixtures. Grooves may be continued through longitudinal joints. Where neoprene compression seals have been installed and the compression seals are recessed sufficiently to prevent damage from the grooving operation. grooves may be continued through the longitudinal joints. Where neoprene compression seals have been installed and the compression seals are not recessed sufficiently to prevent damage from the grooving operation, grooves must not be closer than 3 inches or more than 5 inches from the longitudinal joints.

***621-2.3 ENVIRONMENTAL REQUIREMENTS.** Grooving operations will not be permitted when freezing conditions prevent the immediate removal of debris and/or drainage of water from the grooved area.*

***621-2.4 EXISTING PAVEMENTS.** Bumps, depressed areas, bad or faulted joints, and badly cracked and/or spalled areas in the pavement shall not be grooved until such areas are adequately repaired or replaced.*

***621-2.5 NEW PAVEMENTS.** New asphalt concrete pavements shall be allowed to cure for a minimum of 30 days before grooving, to allow the material to become stable enough to prevent closing of the grooves under normal use. Permit new Portland cement concrete pavements to cure for a minimum of 28 days before grooving. Spalling along or tearing or raveling of the groove edges shall not be allowed.*

621-2.6 CLEAN-UP. *During and after installation of saw-cut grooves, the Contractor must remove from the pavement all debris, waste, and by-products generated by the operations to the satisfaction of the Engineer. Cleanup of waste material must be continuous during the grooving operation. Flush debris produced by the machine to the edge of the grooved area or pick it up as it forms. The dust coating remaining shall be picked up or flushed to the edge of the area if the resultant accumulation is not detrimental to the vegetation or storm drainage system. Accomplish all flushing operations in a manner to prevent erosion on the shoulders. Waste material must be disposed of in an approved manner. Waste material must not be allowed to enter the airport storm or sanitary sewer system.*

The Contractor must dispose of these wastes in strict compliance with all applicable state, local, and Federal environmental statutes and regulations

621-2.7 REPAIR OF DAMAGED PAVEMENT. *Grooving must be stopped and damaged pavement repaired at the Contractor's expense when in the opinion of the Engineer the result of the grooving operation will be detrimental to aircraft tires.*

ACCEPTANCE

621-3.1 ACCEPTANCE TESTING. *Grooves will be accepted based on results of zone testing. All acceptance testing necessary to determine conformance with the groove tolerances specified will be performed by the Engineer.*

Instruments for measuring groove width and depth must have a range of at least 0.5 inches and a resolution of at least 0.005 inches. Gage blocks or gages machined to standard grooves width, depth, and spacing may be used.

Instruments for measuring center-to-center spacing must have a range of at least 3 inches and a resolution of at least 0.02 inches.

The Engineer will measure grooves in five zones across the pavement width. Measurements will be made at least three times during each day's production. Measurements in all zones will be made for each cutting head on each piece of grooving equipment used for each day's production.

The five zones are as follows:

Zone 1	*Centerline to 5 feet left or right of the centerline.*
Zone 2	*5 feet to 25 feet left of the centerline.*
Zone 3	*5 feet 25 feet right of the centerline.*
Zone 4	*25 feet to edge of grooving left of the centerline.*
Zone 5	*25 feet to edge of grooving right of the centerline.*

At a random location within each zone, five consecutive grooves sawed by each cutting head on each piece of grooving equipment will be measured for width, depth, and spacing. The five consecutive measurements must be located about the middle blade of each cutting head plus or minus 4 inches. Measurements will be made along a line perpendicular to the grooves.

Width or depth measurements less than 0.170 inches shall be considered less than 3/16 inches.

Width or depth measurements more than 0.330 inches shall be considered more than 5/16 inches.

Width or depth measurements more than 0.235 inches shall be considered more than 1/4 inches.

Production must be adjusted when more than one groove on a cutting head fails to meet the standard depth, width, or spacing in more than one zone.

METHOD OF MEASUREMENT

621-4.1 ***Method of Measurement.*** *See Section 49-2.*

BASIS OF PAYMENT

621-5.1 ***Measurement.*** *See Section 49-3.*

END OF SECTION P-621

49-2 METHOD OF MEASUREMENT

The yardage of sawcut grooving to be paid for shall be the number of yards of completed and accepted grooving of the type indicated on the bid schedule. The 10 foot equipment turnaround areas will not be measured for payment.

49-3 BASIS OF PAYMENT

For sawcut grooving payment shall be made at the contract unit price per square yard for the quantity, measured in place, of completed and accepted grooving of the type indicated on the bid schedule. This price shall be full compensation for furnishing all materials, labor, supervision, equipment, tools, and incidentals necessary to complete the item.

No additional payment will be made for difficulties encountered when accomplishing work under this section in areas of night construction, or in other areas subject to construction phasing restrictions.

Payment will be made under:

Item 37.1 **[Asphalt][Portland Cement]** Concrete Sawcut Grooving .....per square yard

END OF SECTION 49

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SECTION 50 – OIL COMPANY RIGHT-OF-WAY/ EASEMENT REQUIREMENTS

50-1 GENERAL

Work required for this project will encroach, cross, or impact existing and active pipelines and facilities belonging to several oil companies. These companies include Chevron, ExxonMobil, ConocoPhilips and Shell. Reference to "oil company" or "oil companies" in this specification shall refer to any and/or all of the companies and company facilities listed. Pipelines are active, carrying both jet fuel and/or crude oil.

The following minimum design and facilities specifications and load capacity guidelines have been provided by the oil companies and will be binding on the Contractor at all times during work within the easement or right-of-way for the oil pipelines. The terms easement and right-of-way are used interchangeably in this specification. The right-of-way limits are shown on the plans.

In accordance with State and Federal Government Code regulating hazardous liquids, and guidelines for protection of high-risk pipelines, oil company operations and maintenance procedures require Contractors to "Design to Miss" and "Protect-in-Place". Specific requirements to satisfy these procedures include the following, which are described below:

A. Identify Positive Location.

B. Oil Company Review and Approval.

C. Contractor-Written Job Site Safety Plan (JSSP).

D. Minimum Considerations for Protection of High Risk Pipelines.

E. Minimum Facilities Inspection Requirements.

F. Applicable Federal, State and Local requirements.

The Contractor is advised to allow ample time to coordinate site visits, reviews, approvals, and other actions required on the part of the oil companies.

50-2 IDENTIFY POSITIVE LOCATION

Prior to working within the pipeline right-of-way, the Contractor shall determine pipeline elevations a minimum of every 100 feet. This data shall be used to render accurate profile views of the pipelines so that clearance and maximum allowable load capacities (surcharge and/or overburden) over the pipelines can be determined. The Contractor shall plot detail section and/or profile views within the right-of-way (easement) boundaries; elevation of underground facilities in relation to proposed improvements; existing and proposed grade elevations. Easement boundaries and pipeline locations should be surveyed and delineated on site before any work in

proximity to oil company facilities begins. Information shall include surveyed data for Top of Pipe (TOP) and Top of Grade/Existing Grade Elevations (TOG). Profiles and/or section views shall be rendered on the proposed JSSP Site Plan Drawing(s), indicating general pipeline profile TOP and TOG throughout the limits of work within the oil company right-of-way. Potholes will be measured and paid under Section 18 of these Specifications. Contractor to supply air testers for all potholing near fuel pipelines.

Information shall include surveyed data for Top of Pipe (TOP) and Top of Grade/Existing Grade Elevations (TOG). Profiles and/or section views shall be rendered on the proposed JSSP Site Plan Drawing(s), indicating general pipeline profile TOP and TOG throughout the limits of work within the oil company right-of-way. Potholes will be measured and paid under Section 18 of these Specifications.

50-3 OIL COMPANY REVIEW AND APPROVAL

Before beginning construction activity near or over oil company facilities, the proposed final design and construction plans for the Contractor's "protection in place" or "design to miss" plans relative to oil company facilities must be reviewed and approved by the affected oil company facilities representative and oil company engineering or technical services personnel. This review is required to ensure that minimum safe construction offsets for placement of major structures are established outside of oil company easement boundaries, and that consideration of excessive loads have been calculated and compensated for. All responsible parties must agree upon an appropriately engineered solution for construction activities and improvements proposed in proximity to oil company facilities.

No structural encroachments or improvements impacting safe pipeline operations will be permitted within, or immediately adjacent to, oil company easements (e.g., foundations, footings, trees, parallel fencing and/or utilities etc.). Approvals for proposed improvements within the right-of-way will require engineering and technical calculations to determine:

A. Safe construction and equipment offset distances;

B. Appropriate angles of repose;

C. Surcharge or overburden factors.

These requirements are necessary to insure prevention against undermining the proposed improvements in the event of future oil company pipeline maintenance or emergency excavations to access pipeline facilities.

If it is determined by oil company engineering or technical services that adequate cover, clearance or protection from load bearing forces cannot be obtained within the scope of the proposed project design, it will be necessary to modify, relocate, lower in place, or place additional fill above the oil company pipelines. It is expected that when improvements requiring pipeline system design changes are required, the affected oil company will be reimbursed for

actual costs and shall receive payment of estimated costs in advance before scheduling work for such changes. Such changes may include depth of cover modifications, lowering, relocation, or removal of pipelines. The Contractor shall notify the Engineer immediately when any potential conflicts arise which may require changes in oil pipeline alignment.

The Owner and Contractor associated with the project must agree to sign and abide by the terms of an "Acknowledgement of Line Crossing Procedures" and/or "Hazardous Liquid Substructure Notification", prior to work within the oil company right-of-way.

The Contractor shall determine minimum depth of cover requirements to protect pipelines in place from anticipated loads during and upon completion of construction to ensure compliance with the appropriate oil company polices, pipeline safety laws, government codes and other related regulatory requirements. Where less than five and a half feet of compacted soil cover exists, the project design must provide equivalent protection that will not exceed the maximum anticipated aircraft loading.

Minimum heavy equipment safe working offset distances must be determined to ensure that heavy equipment operations are conducted safely away from the pipelines to prevent equipment mechanical or excess load (rupture) damage to the pipelines.

Specification of appropriate equipment placement and safe working offset distances, including outrigger placement, and utilization and excavation methods for grade cuts or fill over pipelines are to be determined before the beginning of any grading operations. Final import fill and grade cuts over oil company facilities must be approved by the respective oil companies before beginning grading activity.

Final approval will be granted by oil company engineers after they have conferred, confirmed and mutually agreed with the Contractor that oil company facilities are adequately protected from excessive load or potential mechanical damage from proposed construction activities and improvements within the right-of-way.

Oil companies will not permit any excavation activity or improvements over or near oil pipelines or facilities without prior compliance review and final permit approval of the project plans and review and approval of a written Contractor Job Site Safety Plan (JSSP). Final permit approval will be granted by each affected oil company.

50-4 CONTRACTOR-WRITTEN JOB SITE SAFETY PLAN (JSSP)

Prior to undertaking any work in the oil company right-of-way, the Contractor shall develop an appropriate written "Contractor Job Site Safety Plan (JSSP). The JSSP will be a collaborative effort between the Contractor and oil company personnel. It shall be reviewed and approved by all affected oil companies prior to construction within the oil right-of-way.

The purpose of the JSSP is to indicate how the Contractor intends to protect oil company pipelines and facilities during, and upon completion of, construction activities. Primary construction conditions of concern requiring consideration are heavy equipment, and materials placement at critical locations, including heavy equipment crossings and/or grading activity over oil company facilities.

No work will be undertaken in the right-of-way until the JSSP has received written approval from all affected oil companies.

The JSSP will summarize project plans for "Design to Miss" and/or "Protect-in-Place" procedures relative to oil company facilities. It will include pipeline protective measures, proper excavation techniques, and an emergency response protocol that will include evacuation, isolation, deny entry, notification, and emergency shut down procedures.

The JSSP will set forth safe construction plans, proper excavation techniques and equipment placement procedures to protect and support existing pipelines from any excessive anticipated static or dynamic loads. Such loads may cause facilities to move or rupture. Heavy vibratory equipment loading must be considered and alternative compaction methods used to avoid direct stress applied to the pipelines.

Utilization of heavy equipment for extensive equipment runs over, or in immediate proximity to, oil company pipelines require potholing for survey of pipeline elevations as described in paragraph 50-2 "Identify Positive Location", above. Existing grades and depth of soil cover above the pipelines and proposed heavy equipment weight ratings are required to determine accurate maximum allowable load capacities of the pipelines.
Minimum consideration for the JSSP includes, but is not limited to, the following:

A. Plans showing results of the "Identify Positive Location" requirements of Paragraph 50-2. A minimum of three (3) section views shall be provided - one on each end and one at the middle of the excavation limits or zone of impact. This information will be presented on a site plan drawing from the project plan set.

B. Determination of "Maximum Allowable Loads" over oil pipelines, and provision for "Design to Miss" or "Protect-in-Place" to prevent rupture due to excessive load stress or mechanical damage.

C. A Vehicle/Equipment list, such as the sample form included at the end of this specification, listing vehicles and equipment which the Contractor proposes to use inside the oil right of way. The list shall include the make, model, and equipment weight ratings, of all vehicles and equipment proposed, with a column for indication of rubber tired (and number of tires) or track mounted equipment type. This data, submitted with the JSSP, will allow oil company engineers to calculate or confirm the maximum allowable loads permitted over oil company facilities.

D. A site plan drawing designating the approved roadway crossings and haul routes

for heavy equipment and materials crossing over oil company facilities. These locations shall be only at the locations pre-approved by the oil companies for proposed "maximum allowable loads". All areas not approved for crossing will be barricaded off and delineated to deny entry. Project plans shall be "redlined" to show "approved for heavy equipment" locations.

50-5 MINIMUM CONSIDERATIONS FOR PROTECTION OF HIGH RISK PIPELINES

A. Excavators must verify exact elevations/depth of cover of oil company facilities in conflict with the project by excavating with hand tools. Oil company facilities are to be exposed by hand digging only, before using power-operated equipment, over or within pipeline easements operated or maintained by oil companies. Depth of cover data obtained during pothole surveys shall be, and shall remain, the proprietary and confidential property of the respective oil company. Contractors may use data obtained for the sole purpose of assisting with design of the project, to determine proper excavation techniques and construction requirements, to protect pipelines in place during project activity over or near oil company facilities, and for preventing unauthorized or illegal encroachment of such facilities.

B. Oil company facilities must be protected from hazards causing pipelines to move or sustain abnormal loads, or excess localized stress and potential pipeline rupture. Anticipated external loads over or near oil company facilities must be provided for, both during construction and upon completion of approved improvements. Depth of cover data must be obtained for calculation of safe load bearing factors which shall be determined before deployment of heavy equipment or placement of load-bearing structures over oil company pipelines is allowed.

C. Final depth of cover over oil company facilities must meet requirements for the expected maximum load application, as approved by oil company engineering and/or technical services departments. Adequate ground cover is critical for maintaining safe pipeline operations. Existing cover over oil company lines is to be field verified by the Contractor under observation of the assigned oil company facilities inspector.

D. Specific details of proposed utilities crossing oil company pipelines shall be planned in advance with the owning oil company. Installation of utility crossings must be placed below oil company facilities and shall provide 24 inches clearance, if feasible. In no case shall clearance be less than 12 inches. Only lateral service crossings are permitted within oil company easements. Parallel utilities are not allowed.

E. Oil company facilities are cathodically protected. In the event that proposed improvements in the oil company right-of-way requires the use of metallic pipes or structures, it is absolutely necessary that arrangements be made for the protection of

oil company facilities in order to prevent problems of electrical interference upon the pipelines.

F. Proposed backfill material must provide pipe support and protection for any pipe coatings. Only rock free native soil, clean sand, or zero sack slurry may be used as backfill material. No cement slurry will be allowed within 24 inches of oil company pipelines.

G. Grade design must provide adequate protective soil cover allowing pipelines to withstand dynamic forces exerted by anticipated traffic loads, during and upon completion of construction activity.

H. Equipment lists specifying fully loaded gross vehicle weights must be provided to confirm that maximum allowable loads will not apply excessive loads or abnormal bearing forces that may cause pipelines to move, rupture or sustain mechanical damage.

I. Proposed grade changes must be approved by oil company facilities representatives and engineering or technical services. Excessive fill will not be permitted over oil company facilities. Changes to existing pipeline cover within 50 feet of any oil company pipeline will require adjustment to insure a minimum of 48 inches cover above the pipelines.

J. To prevent undermining of proposed structures, and to allow for safe construction offset for future routine or emergency pipeline maintenance excavation access, structural improvements in the oil company right-of-way must provide for minimum safe construction offsets of:

(1) A minimum of five (5) feet outside of right-of-way boundaries, or

(2) A one and a half to one (1½ : 1) excavation angle of repose from the pipeline nearest to proposed structures, or

(3) A dimension required by government code, whichever of items 1 through 3 is greater.

(4) Field conditions preventing minimum safe offsets require minimum footing depths of 24 inches to 30 inches or more below the bottom of the deepest pipeline within the easement. In order to prevent stress in excess of maximum allowable loads to the pipelines, footings must ensure that the angle load influence miss underground pipelines. In no case will the face of footings be permitted with less than 36 inches horizontal clearance from the pipeline nearest the proposed structural footings.

K. The right-of-way must be securely maintained with clear, unobstructed, routine maintenance excavation access and emergency ingress and egress at all times, during, and upon completion of, construction improvements

L. The Contractor shall utilize high visibility barricades or K-Rail barriers, of the types as shown on the plans, to field delineate oil facilities. Markers shall include delineation of the right-of-way boundaries and pipeline alignment as shown on project design plans.

M. A preliminary pre-job safety orientation meeting with oil company facilities inspectors, project superintendents and excavation contractor crews shall be held prior to the start of construction. To ensure that Contractor employees and subcontractors are aware of proper actions to follow in the event pipelines are damaged or ruptured and fuel or oil is potentially released, protective measures and emergency response procedures which are presented in the JSSP will be reviewed with all affected project employees at all project safety meetings.

N. Representatives from the Owner, the Contractor, and the oil companies will conduct "tail gate" safety meetings before each new work period and after any new equipment operator turnover.

50-6 MINIMUM FACILITIES INSPECTION REQUIREMENTS

A. An oil company representative for the affected pipeline must be present whenever Contractors are potholing or working over or near oil company facilities.

B. The Contractor shall notify all affected oil company inspectors at the numbers listed below, and Underground Service Alert at (800) 227-2600 a minimum of 2 to 14 working days prior to any on-site work. Oil company contacts are:

[UPDATE / CONFIRN ALL CONTACTS]

ExxonMobil:
Don Kingston
12851 E. 166th St. Room 123
Cerritos, Ca 90703
Office: 310-212-1768

Chevron:
Gerald McClellan
16301 Trojan Way
Bldg. R01/B561
La Mirada, Ca 90638
Project Reference Number: 04-007
Ph:714-228-1530

Cell:714- 228-1503

ConocoPhilips:
Joseph Mendoza
2650 West Lomita Blvd.
Torrance, CA 90505
Cell: 310-466-8188
Pager: 310-841-1539

Shell:
Alan Davis
20945 S. Wilmingon Avenue
Carson, Ca 90810
Office: 559-935-2022 x103

50-7 APPLICABLE FEDERAL, STATE AND LOCAL REQUIREMENTS

Failure to comply with requirements of Pipeline Safety Laws, or other applicable Federal, State or Local laws or regulations, will subject the Contractor to liability for any damage incurred to oil company facilities during excavation or construction operations. Civil and/or criminal penalties may result from failure to comply.

50-8 LOAD BEARING CAPACITY GUIDELINES FOR PIPELINES

The Contractor shall use the information contained in Table 49.1 and Figure 49.1 as guidelines for planning his proposed equipment, operations, and improvements within the oil company right-of-way. Final approval of the adequacy of protection remains with the individual oil companies.

50-9 MEASUREMENT AND PAYMENT

Requirements under this Section will not be measured for payment, but will be considered incidental to the respective work items. Potholing will not be measured for payment except as stated in Section 18 of these specifications.

50-10 SAMPLE FORM

Table 50.2, in the following page, presents a sample of an acceptable Vehicle / Equipment form for inclusion in the JSSP.

Table 50.1 LOAD BEARING CAPACITY GUIDELINES FOR PIPELINES

Maximum Allowable Vehicle Weight

Coverage Over the Top of the Pipe inches	4-inch pipe pounds	6-inch pipe pounds	8-inch pipe pounds	10-inch pipe pounds	12-inch pipe pounds	18-inch pipe pounds	20-inch pipe pounds
6	26,000	15,000	11,000	9,000	7,000	6,000	5,000
12	47,000	27,000	20,000	16,000	14,000	9,000	7,000
18	73,000	42,000	29,000	23,000	20,000	11,000	8,500
24	106,000	60,000	42,000	32,000	27,000	14,000	10,500
30	150,000	82,000	56,000	43,000	35,000	17,000	12,000
36	200,000	106,000	72,000	54,000	43,000	20,000	12,500
42	255,000	136,000	90,000	67,000	53,000	21,000	12,000
48	320,000	168,000	109,000	80,000	62,000	22,000	10,000
Assumptions:							
1.	Grade-B pipe strength						
2.	Lap Weld Joints						
3.	Schedule 10 pipe wall thickness						
4.	Vehicle has 4 wheels						
5.	Weight includes vehicle-driver-cargo-fuel						
6.	Weight does not include dynamic forces of a moving vehicle over rough terrain						
7.	Analysis performed with the typical 1.25 factor of safety						
8.	Internal pipe pressure = 0-psi						

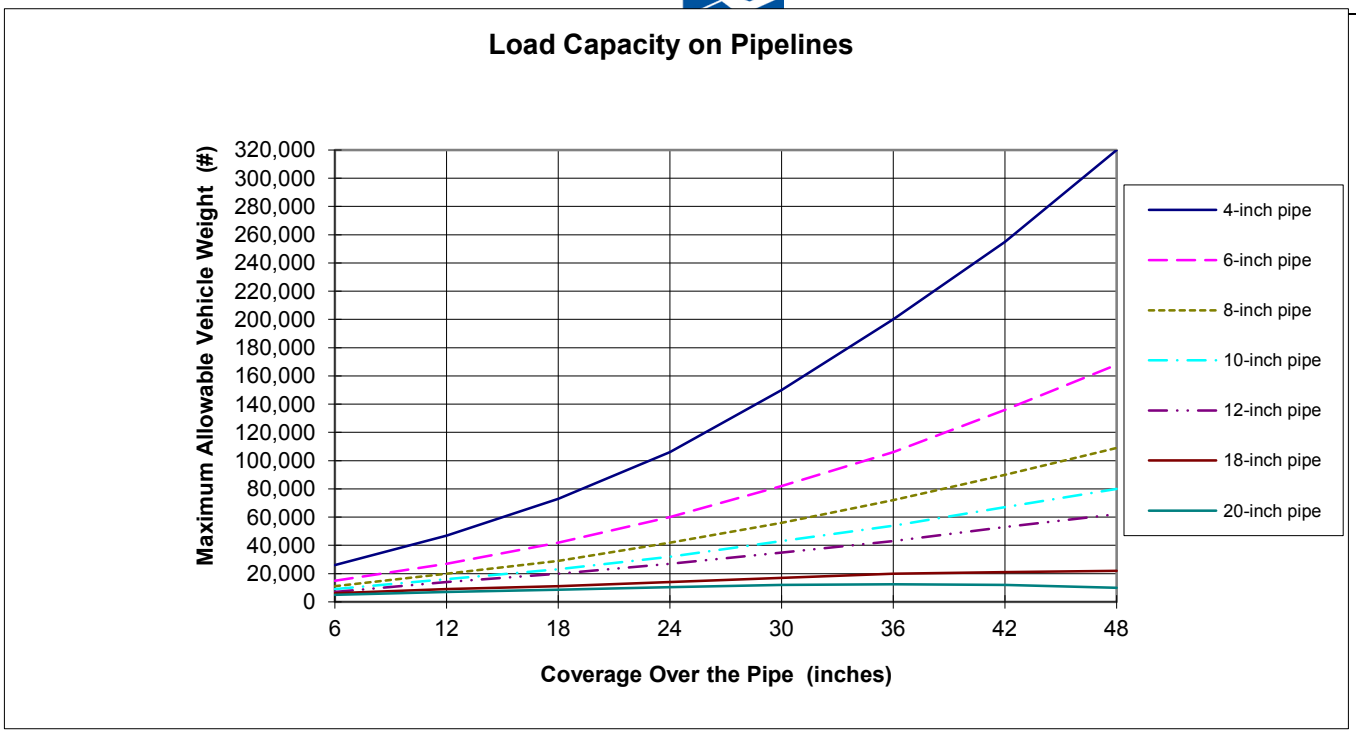
Load Capacity on Pipelines
Maximum Allowable Vehicle Weight (#)
320,000
300,000
280,000
260,000
240,000
220,000
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
6
12
18
24
30
36
42
48
Coverage Over the Pipe (inches)
4-inch pipe
6-inch pipe
8-inch pipe
10-inch pipe
12-inch pipe
18-inch pipe
20-inch pipe

Figure 50.1

TABLE 50.2 – PROPOSED EQUIPMENT LIST CROSSING OIL COMPANY PIPELINES							
Equipment	**Make/Model**	**Gross Wt (lbs)**	**Downward Pressure (psi)**	**Bucket Size (cu yds)**	**Rubber Tires (# of tires)**	**Track Mount (Width & Length)**	**Submitted by:**

END OF SECTION 50

SECTION 54 – STRUCTURAL CONCRETE (FAA P-610)

54-1 GENERAL

The Contractor shall perform all work required by the plans requiring structural concrete for drainage structures, electrical foundations, and miscellaneous other uses, in accordance with Sections 200, 201, and 303 of the Standard Specifications, except as specified otherwise in FAA Specification Item P-610, as included and modified hereafter, and as shown on the Plans.

ITEM P-610 STRUCTURAL PORTLAND CEMENT CONCRETE

DESCRIPTION

610-1.1 *This item shall consist of plain or reinforced structural portland cement concrete, prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans.*

MATERIALS

610-2.1 GENERAL. *Only approved materials, conforming to the requirements of these specifications, shall be used in the work. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The source of supply of each of the materials shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be scored and handled to insure the preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed therein.*

In no case shall the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregates shall be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates will not be permitted.

Aggregates shall be tested for deleterious reactivity with alkalies in the cement that may cause excessive expansion of the concrete. Acceptance of aggregates shall be based upon satisfactory evidence furnished by the Contractor that the aggregates, combined with other mixture constituents, do not produce excessive expansion in the concrete. This evidence shall include service records of concrete of comparable properties under similar conditions or exposure and certified

records of tests by a testing laboratory that meets the requirements of ASTM C 1077. Tests shall be made in accordance with ASTM C 1260. Test specimens shall be produced using all components (e.g. coarse aggregate, fine aggregate, cement and fly ash…) to be included in the produced concrete. If the mean expansion of the test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 16 days from casting the aggregates shall be accepted. If the mean expansion at 16 days is greater than 0.10% but less than 0.15%, the aggregate may be accepted based upon satisfactory service records and acceptance of the aggregate by a State Highway Department specifically addressing Alkali-Silica Reactivity. If the expansion is greater than 0.15%, the aggregate shall not be accepted for use.

610-2.2 COARSE AGGREGATE. *The coarse aggregate for concrete shall meet the requirements of ASTM C 33. Crushed stone aggregate shall have a durability factor, as determined by ASTM C 666, greater than or equal to 95. The Engineer may consider and reserve final approval of other State classification procedures addressing aggregate durability.*

Coarse aggregate shall be well graded from coarse to fine and shall meet one of the gradations shown in Table 1, using ASTM C 136.

610-2.3 FINE AGGREGATE. *The fine aggregate for concrete shall meet the requirements of ASTM C 33.*

The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of Table 2 when tested in accordance with ASTM C 136:

Table 1
GRADATION FOR COARSE AGGREGATE

Sieve Designation (square openings)	Percentage by Weight Passing Sieves						
	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4
No. 4 to 3/4 in.			100	90-100		20-55	0-10
No. 4 to 1 in.		100	90-100		25-60		0-10
No. 4 to 1-1/2 in.	100	95-100		35-70		10-30	0-5

Table 2 *GRADATION FOR FINE AGGREGATE*	
Sieve Designation (square openings)	*Percentage by Weight Passing Sieves*
3/8 inch	*100*
No. 4	*95-100*
No. 16	*45-80*
No. 30	*25-55*
No. 50	*10-30*
No. 100	*2-10*

Blending will be permitted, if necessary, in order to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than portland cement, as specified in 610-2.6 on admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

610-2.4 CEMENT. *Cement shall conform to the requirements of ASTM C150, Type II or V.*

The Contractor shall furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. The report shall be delivered to the Engineer before permission to use the cement is granted. All such test reports shall be subject to verification by testing sample materials received for use on the project.

610-2.5 WATER. *The water used in concrete shall be free from sewage, oil, acid, strong alkalies, vegetable matter, and clay and loam. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.*

610-2.6 ADMIXTURES. *The use of any material added to the concrete mix shall be approved by the Engineer. Before approval of any material, the Contractor shall be required to submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests shall be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.*

Pozzolanic admixtures shall be fly ash or raw or calcined natural pozzolons meeting the requirements of ASTM C 618.

Air-entraining admixtures shall meet the requirements of ASTM C 260. Air-entraining admixtures shall be added at the mixer in the amount necessary to produce the specified air content.

Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.

High-range water reducers will not be allowed.

610-2.7 PREMOLDED JOINT MATERIAL. *Pre-molded joint material for expansion joints shall meet the requirements of ASTM D1751 or ASTM D1752.*

610-2.8 JOINT FILLER. *The filler for joints shall meet the requirements of Section 42 (FAA Item P-6050, unless otherwise specified in the proposal.*

610-2.9 STEEL REINFORCEMENT. *Reinforcing shall conform to the following requirements, as appropriate to the details shown on the Plans.*

Welded Deformed Steel Fabric	*ASTM A497*
Bar Mats	*ASTM A184 or A704*

610-2.10 COVER MATERIALS FOR CURING. *Curing materials shall conform to one of the following specifications:*

Waterproof paper for curing concrete	*ASTM C 171*
Polyethylene Sheeting for Curing Concrete	*ASTM C 171*
Liquid Membrane-Forming Compounds for Curing Concrete	*ASTM C 309, Type 2*

CONSTRUCTION METHODS

610-3.1 GENERAL. *The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified herein. All machinery and equipment owned or controlled by the Contractor, which he proposes to use on the work, shall be of sufficient size to meet the requirements of the work, and shall be such as to produce satisfactory work; all work shall be subject to the inspection and approval of the Engineer.*

610-3.2 CONCRETE COMPOSITION. *Concrete shall develop a compressive strength of 4,000 psi in 28 days for structures under full strength PCC and asphalt pavements and 3,000 psi in 28 days for all other areas, unless otherwise*

stated in the Plans or Specifications, as determined by test cylinders made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The concrete shall contain not less than 470 pounds of cement per cubic yard. The concrete shall contain 5% of entrained air, plus or minus 1%, as determined by ASTM C 231 and shall have a slump of not more than 4 inches as determined by ASTM C 143.

610-3.3 ACCEPTANCE SAMPLING AND TESTING. *Concrete for each structure will be accepted on the basis of the compressive strength specified in paragraph 3.2. The concrete shall be sampled in accordance with ASTM C 172. Compressive strength specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39.*

Concrete cylindrical test specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The Contractor shall cure and store the test specimens under such conditions as directed. The Engineer will make the actual tests on the specimens at no expense to the Contractor.

610-3.4 PROPORTIONING AND MEASURING DEVICES. *When package cement is used, the quantity for each batch shall be equal to one or more whole sacks of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment. Weighing boxes or hoppers shall be approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so that the required and exact weight of aggregates can be readily obtained.*

610-3.5 CONSISTENCY. *The consistency of the concrete shall be checked by the slump test specified in ASTM C 143.*

610-3.6 MIXING. *Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C 94.*

610-3.7 MIXING CONDITIONS. *The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F (4°C) without permission of the Engineer. If permission is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F (10°C) nor more than 100°F (38°C). The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his/her expense.*

Retempering of concrete by adding water or any other material shall not be permitted.

The delivery of concrete to the job shall be in such a manner that batches of concrete will be deposited at uninterrupted intervals.

***610-3.8 FORMS**. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the Engineer. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as designed on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The Contractor shall bear responsibility for their adequacy. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes.*

The internal ties shall be arranged so that, when the forms are removed, no metal will show in the concrete surface or discolor the surface when exposed to weathering. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied shortly before the concrete is placed. Forms shall be constructed so that they can be removed without injuring the concrete or concrete surface. The forms shall not be removed before the expiration of at least 30 hours from vertical faces, walls, slender columns, and similar structures; forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate that at least 60% of the design strength of the concrete has developed.

***610-3.9 PLACING REINFORCEMENT.** All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.*

***610-3.10 EMBEDDED ITEMS.** Before placing concrete, any items that are to be embedded shall be firmly and securely fastened in place as indicated. All such items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood shall be avoided. The concrete shall be spaded and consolidated around and against embedded items.*

***610-3.11 PLACING CONCRETE.** All concrete shall be placed during daylight, unless otherwise approved. The concrete shall not be placed until the depth and character of foundation, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved. Concrete shall be placed as soon as practical after mixing and in no case later than 1 hour after water has been added to the mix. The method and manner of placing shall be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used*

as an aid in placing concrete when necessary. Dropping the concrete a distance of more than 5 feet, or depositing a large quantity at one point, will not be permitted. Concrete shall be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.

The concrete shall be compacted with suitable mechanical vibrators operating within the concrete. When necessary, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators shall be manipulated so as to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any joint shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket, or other approved method and shall not be disturbed after being deposited.

610-3.12 CONSTRUCTION JOINTS. *When the placing of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, such provisions shall be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed. The work shall be arranged so that a section begun on any day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete that has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.*

610-3.13 EXPANSION JOINTS. *Expansion joints shall be constructed at such points and of such dimensions as may be indicated on the drawings. The premolded filler shall be cut to the same shape as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.*

610-3.14 DEFECTIVE WORK. *Any defective work discovered after the forms have been removed shall be immediately removed and replaced. If any dimensions are deficient, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of the Engineer cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.*

610-3.15 SURFACE FINISH. *All exposed concrete surfaces shall be true, smooth, and free from open or rough spaces, depressions, or projections. The concrete in horizontal plane surfaces shall be brought flush with the finished top surface at the proper elevation and shall be struck-off with a straightedge and*

floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

When directed, the surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall be pointed and wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface. When approved, the finishing can be done with a rubbing machine.

610-3.16 CURING AND PROTECTION. *All concrete shall be properly cured and protected by the Contractor. The work shall be protected from the elements, flowing water, and from defacement of any nature during the building operations. The concrete shall be cured as soon as it has sufficiently hardened by covering with an approved material. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for a period of at least 3 days. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to currents of air. Where wooden forms are used, they shall be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for 7 days after the concrete has been placed.*

610-3.17 DRAINS OR DUCTS. *Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.*

610-3.18 COLD WEATHER PROTECTION. *When concrete is placed at temperatures below 40°F (4°C), the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, shall be heated in order to place the concrete at temperatures between 50°F and 100°F (10°C and 38°C).*

Calcium chloride may be incorporated in the mixing water when directed by the Engineer. Not more than 2 pounds of Type 1 nor more than 1.6 pounds of Type 2 shall be added per bag of cement. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50°F (10°C) until at least 60% of the designed strength has been attained.

610-3.19 FILLING JOINTS. *All joints that require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools.*

Joint filling shall not be started until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

METHOD OF MEASUREMENT

610-4.1 *See Section 54-2.*

BASIS OF PAYMENT

610-5.1 *See Section 54-3.*

TESTING REQUIREMENTS

ASTM C 31	*Making and Curing Test Specimens in the Field*
ASTM C 39	*Compressive Strength of Cylindrical Concrete Specimens*
ASTM C 136	*Sieve Analysis of Fine and Coarse Aggregates*
ASTM C 138	*Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete*
ASTM C 143	*Slump of Hydraulic Cement Concrete*
ASTM C 231	*Air Content of Freshly Mixed Concrete by the Pressure Method*
ASTM C 666	*Resistance of Concrete to Rapid Freezing and Thawing*
ASTM C 1077	*Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation*
ASTM C 1260	*Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)*

MATERIAL REQUIREMENTS

ASTM A 184	*Specification for Fabricated Deformed Steel Bar or Rod Mats for Concrete Reinforcement*

ASTM A 185	*Steel Welded Wire Fabric, Plain, for Concrete Reinforcement*
ASTM A 497	*Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement*
ASTM A 615	*Deformed and Plain Billet-Steel Bars for Concrete Reinforcement*
ASTM A 704	*Welded Steel Plain Bars or Rod Mats for Concrete Reinforcement*
ASTM C 33	*Concrete Aggregates*
ASTM C 94	*Ready-Mixed Concrete*
ASTM C 150	*Portland Cement*
ASTM C 171	*Sheet Materials for Curing Concrete*
ASTM C 172	*Sampling Freshly Mixed Concrete*
ASTM C 260	*Air-Entraining Admixtures for Concrete*
ASTM C 309	*Liquid Membrane-Forming Compounds for Curing Concrete*
ASTM C 494	*Chemical Admixtures for Concrete*
ASTM C 595	*Blended Hydraulic Cements*
ASTM C 618	*Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete*
ASTM D 1751	*Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)*

ASTM D 1752 Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

AASHTO T 26 Quality of Water to be Used in Concrete

END OF ITEM P-610

54-2 METHOD OF MEASUREMENT

Structural concrete will not be measured separately for payment but shall be included in the prices bid for the particular items which reference it.

54-3 BASIS OF PAYMENT

Structural concrete is considered incidental to other associated bid items and no separate payment will be made.

END OF SECTION 54

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SECTION 55 – PIPE FOR STORM DRAINS AND CULVERTS (FAA D-701)

55-1 GENERAL

The Contractor shall perform all work required by the plans for construction of pipe for storm drains, precast polymer trench drains and culverts in accordance with the Standard Specifications, or the Standard Plans referenced, except as specified otherwise in FAA Specification Item D-701, as included and modified hereafter, and as shown on the plans.

Unless otherwise noted on the plans, all Reinforced Concrete Pipe shall be ASTM C 76 ClassV rated, or as shown on the Storm Drain pipe profile sheets in the plans.

Some storm drain pipe will be installed in areas of limited-time night construction as shown on the phasing sheets in the plans. The Contractor is responsible for determining the difficulties associated with installation of pipe under these conditions. He shall plan his construction approach accordingly and include additional costs associated with construction in these areas in his unit prices.

ITEM D-701 PIPE FOR STORM DRAINS AND CULVERTS

DESCRIPTION

701-1.1 *This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.*

MATERIALS

701-2.1 *Materials shall meet the requirements shown on the plans and specified below.*

701-2.2 PIPE. *The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements.*

Reinforced Concrete Pipe .....ASTM C 76
Reinforced Concrete D-Load Pipe.....ASTM C 665
Reinforced Concrete Arch Pipe .....ASTM C 506
PVC Pipe ..... ASTM M 304

All pipe used on the project shall be Class V, per ASTM C76 unless otherwise indicated on the plans. PVC pipe shall be Schedule 80.

701-2.3 CONCRETE. *Concrete for pipe cradles shall have a minimum compressive strength of 2000 psi at 28 days and conform to the requirements of ASTM C 94.*

701-2.4 RUBBER GASKETS. *Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C 443.*

701-2.5 JOINT MORTAR. *Pipe joint mortar shall consist of one part portland cement and two parts sand. The portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144.*

701-2.6 JOINT FILLERS. *Poured filler for joints shall conform to the requirements of ASTM D 1190.*

701-2.7 PLASTIC GASKETS. *Plastic gaskets shall conform to the requirements of AASHTO M 198 (Type B).*

[701-2.8. CONTROLLED LOW STRENGTH MATERIAL (CLSM). Controlled low strength material shall conform to the requirements of Item Section24 of these specifications (FAA Item P-153). When CLSM is used all joints shall have gaskets.]

CONSTRUCTION METHODS

701-3.1 EXCAVATION. *The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 6 inches on each side. The trench walls shall be approximately vertical.*

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 12 inches or one-half inch for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The width of the excavation shall be at least 1 foot greater than the horizontal outside diameter of the pipe. The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches in uncompacted depth to form a uniform but yielding foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The Engineer shall

determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes that are placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

701-3.2 BEDDING. *The pipe bedding shall conform to the class specified on the plans. When no bedding class is specified or detailed on the plans, the requirements for Class C bedding shall apply.*

a. Rigid Pipe. *Class A bedding shall consist of a continuous concrete cradle conforming to the plan details.*

Class B bedding shall consist of a bed of granular material having a thickness of at least 6 inches below the bottom of the pipe and extending up around the pipe for a depth of not less than 30 percent of the pipe's vertical outside diameter. The layer of bedding material shall be shaped to fit the pipe for at least 10 percent of the pipe's vertical diameter and shall have recesses shaped to receive the bell of bell and spigot pipe. The bedding material shall be sand or selected sandy soil, all of which passes a 3/8 inch sieve and not more than 10 percent of which passes a No. 200 sieve.

Class C bedding shall consist of bedding the pipe in its natural foundation to a depth of not less than 10 percent of the pipe's vertical outside diameter. The bed shall be shaped to fit the pipe and shall have recesses shaped to receive the bell of bell and spigot pipe.

a. PVC and Polyethylene Pipe. *For PVC and polyethylene pipe, the bedding material shall consist of coarse sands and gravels with a maximum particle size of 3/4-inch. For pipes installed under paved areas, no more than 12 percent of the material shall pass the No. 200 sieve. For all other areas, no more than 50 percent of the material shall pass the No. 200 sieve. The bedding shall have a thickness of at least 6 inches below the bottom of the pipe and extend up around the pipe for a depth of not less than 50 percent of the pipe's vertical outside diameter.*

701-3.3 LAYING PIPE. *The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.*

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced pipes shall be placed with the manufacturer's top of pipe mark within five degrees of a vertical plane through the longitudinal axis of the pipe.

In areas of limited extent, such as night construction areas, it may be infeasible to proceed with pipe laying in an upgrade manner. In these areas, if approved by the Engineer, the Contractor may proceed otherwise, but must provide, to the satisfaction of the Engineer, other methods of stabilizing pipe sections to ensure that no separation of joints occurs.

701-3.4 JOINING PIPE. *Joints shall be made with (1) portland cement mortar, (2) portland cement grout, (3) rubber gaskets, (4) plastic gaskets, or (5) coupling bands.*

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints in order to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

a. Concrete Pipe. *Concrete pipe may be either bell and spigot or tongue and groove. The method of joining pipe sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even. Joints shall be thoroughly wetted before mortar or grout is applied.*

b. PVC and Polyethylene Pipe. *Joints for PVC and Polyethylene pipe shall conform to the requirements of ASTM D 3212 when water tight joints are required. Joints for PVC and Polyethylene pipe shall conform to the requirements of AASHTO M 304 when soil tight joints are required. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M 252 or M 294M.*

701-3.5 BACKFILLING. *Pipes shall be inspected before any backfill is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense. Loose soil, formwork and debris shall be removed prior to backfilling.*

*Material for backfill shall be fine, readily compatible soil, granular material selected from the excavation or a source of the Contractor's choosing**[, or shall be CLSM conforming to Section 24 of these specifications]**. It shall not contain frozen lumps, stones that would be retained on a 2-inch sieve, chunks of highly plastic clay, or other objectionable material. No less than 95 percent of a granular backfill material shall pass through a 1/2 inch sieve, and no less than 95 percent of it shall be retained on a No. 4 sieve.*

When the top of the pipe is even with or below the top of the trench, the backfill shall be compacted in layers not exceeding 6 inches on both sides of the pipe and shall be brought up one foot above the top of the pipe or to natural ground level, whichever is greater. Care shall be exercised to thoroughly compact the backfill material under the haunches of the pipe. Material shall be brought up evenly on both sides of the pipe.

When the top of the pipe is above the top of the trench, the backfill shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on both sides of the pipe to 1 foot above the top of the pipe. The width of backfill on each side of the pipe for the portion above the top of the trench shall be equal to twice the pipe's diameter of 12 feet, whichever is less

For PVC and polyethylene pipe, the backfill shall be placed in two stages; first to the top of the pipe and then at least 12 inches over the top of the pipe. The backfill material shall meet the requirements of paragraph 701-3.2c.

All backfill shall be compacted to the density required under Section 23 of these specifications - Earthwork (FAA Item P-152).

METHOD OF MEASUREMENT

701-4.1 *See Section 55.2*

BASIS OF PAYMENT

701-5.1 *See Section 55.3*

MATERIAL REQUIREMENTS

ASTM C 14	*Concrete Sewer, Storm Drain, and Culvert Pipe*
ASTM C 76	*Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe*
ASTM C 94	*Ready Mixed Concrete*
ASTM C 144	*Aggregate for Masonry Mortar*
ASTM C 150	*Portland Cement*
ASTM C 443	*Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets*

ASTM C 506	*Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe*
ASTM C 507	*Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe*
ASTM C 655	*Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe*
ASTM C 1433	*Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers*
ASTM D 1056	*Flexible Cellular Materials—Sponge or Expanded Rubber*
ASTM D 3034	*Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings*
ASTM D 3212	*Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals*
ASTM D 6690	*Joint and Crack Sealants, Hot-Applied, for Concrete and Asphalt Pavements*
ASTM F 477	*Elastomeric Seals (Gaskets) for Joining Plastic Pipe*
ASTM F 794	*Poly (Vinyl Chloride) Ribbed Drain Pipe & Fittings Based on Controlled Inside Diameter*
ASTM F 949	*Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings*
AASHTO M 190	*Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches*
AASHTO M 198	*Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets*
AASHTO M 304	*Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter*

END ITEM D-701

55-2 METHOD OF MEASUREMENT

The length of pipe to be paid shall be measured in linear feet of pipe in place, completed, and approved of the various sizes and types indicated. It shall be measured horizontally along the centerline of the pipe from centerline to centerline of drainage structures. The several classes, types and size shall be measured separately. All fittings shall be included in the footage of the pipe being measured. Where pipe is to be placed and capped or plugged for future connection, all materials and costs associated with capping or plugging the pipe in the manner indicated on the plans shall be considered incidental to the placement of the pipe, and no separate measurement or payment will be made.

55-3 BASIS OF PAYMENT

Payment will be made at the contract unit price per linear foot for each kind of pipe of the type and size designated. These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, trenching, bedding, placement, backfill, and for capping or plugging where required by the plans; installation of these materials; and for all labor, supervision, equipment, tools, and incidentals necessary to complete the item.

No additional payment will be made for difficulties encountered when constructing pipes in areas of night construction, or in other areas subject to construction phasing restrictions.

Payment shall be made under:

Item 55.1 Construct [ ]" RCP Storm Drain Class [ ] ..... per linear foot

Item 55.11 Construct [ ]" x [ ]" Arch RCP Storm Drain ..... per linear foot

Item 55.14 Construct [ ]" PVC Storm Drain ..... per linear foot

END OF SECTION 55

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SECTION 58 – MANHOLES, CATCH BASINS, INLETS AND MISCELLANEOUS UTILITY SYSTEM WORK (FAA ITEMS D-751, D-752 AND D-754)

58-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of manholes, catch basins, concrete collars, modifying catch basins, and adjusting miscellaneous utility structures to grade for storm drain systems in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item D-751, Manholes, Catch Basins, Inlets and Miscellaneous Utility System Work; Item D-752 Concrete Culverts, Headwalls, and Miscellaneous Drainage Structures; and Item D-754, Concrete Gutters, Ditches, And Flumes, as included and modified hereafter, and as shown on the Plans.

[Some drainage and utility system structures and work installation may be in areas of limited-time night construction as shown on the phasing sheets in the plans. The Contractor is responsible for determining the difficulties associated with this work under these conditions, shall plan his construction approach accordingly, and shall make the necessary allowances for associated additional costs in his bid items.]

ITEM D-751 MANHOLES, CATCH BASINS, INLETS AND INSPECTION HOLES

DESCRIPTION

751-1.1 *This item shall consist of construction of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.*

MATERIALS

751-2.1 BRICK. *Section not used.*

751-2.2 MORTAR/GROUT. *Mortar shall consist of one part portland cement and two parts sand. The portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144.*

Grout shall have a compressive strength of 2,000 psi at 28 days unless otherwise indicated. The grout shall be installed in one continuous operation at a time as allowed by the Engineer. Care shall be taken to prevent grout from leaking out of the ends of the casing pipe during the curing period.

751-2.3 CONCRETE. *Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Section 54 (FAA Item P-610).*

751-2.4 PRECAST CONCRETE PIPE MANHOLE RINGS. *Precast concrete pipe manhole rings shall conform to the requirements of ASTM C 478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches nor more than 48 inches.*

751-2.5 CORRUGATED METAL. *Corrugated metal shall conform to the requirements of AASHTO M 36.*

751-2.6 FRAMES, COVERS, AND GRATES. *The castings shall conform to one of the following requirements:*

- ***a.*** *Gray iron castings shall meet the requirements of ASTM A 48, Class 30B and 35B.*
- ***b.*** *Malleable iron castings shall meet the requirements of ASTM A 47.*
- ***c.*** *Steel castings shall meet the requirements of ASTM A 27.*
- ***d.*** *Structural steel for grates and frames shall conform to the requirements of ASTM A 283, Grade D.*
- ***e.*** *Ductile iron castings shall conform to the requirements of ASTM A 536.*
- ***f.*** *Austempered ductile iron castings shall conform to the requirements of ASTM A 897.*

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A 123.

All castings shall be capable of supporting the loads in paragraph 751-2.8.

751-2.7 STEPS. *The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of bituminous paint, when directed.*

751-2.8 LOAD RATING. *Load calculations shall be submitted confirming the ability of all structures, frames, grates and covers to provide support for the following aircraft:*

(1) Dual-wheel, 48,800# per wheel gear assembly of the Boeing 727; 34 inch center-to-center wheel spacing;

(2) Dual-Tandem (four-wheel), 57,900# per wheel, gear assembly of the Boeing 747-800; 46.8 inch transverse and 56.5 inch longitudinal center-to-center wheel spacing; and

(3) Tridem (six-wheel), 58,900# per wheel, gear assembly of the Airbus A380, 53 inch transverse and 67 inch longitudinal center-to-center wheel spacing.

Contact tire pressure should be assumed to be 221 psi.

CONSTRUCTION METHODS

751-3.1 UNCLASSIFIED EXCAVATION.

a. *The Contractor shall do all excavation for structures and structure footings to the lines and grades or elevations, shown on the plans, or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. All soft and unsuitable material shall be removed and replaced with suitable approved material. A layer of Processed Miscellaneous Base, conforming to Section 200-2.5 of the 2009 Standard Specifications for Public Works Construction (Greenbook) shall be placed and compacted to the thickness indicated on the plans, to form a subbase Compaction shall be to 90% of D1557. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.*

b. *Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.*

c. *The Contractor shall do all bracing, sheathing, or shoring necessary to*

implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

d. *Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.*

e. *After each excavation is completed, the Contractor shall notify the Engineer to that effect; and concrete or reinforcing steel shall be placed after the Engineer has approved the depth of the excavation and the character of the foundation material.*

751-3.2 BRICK STRUCTURES. *Section not used.*

751-3.3 CONCRETE STRUCTURES. *Concrete structures shall be built on prepared foundations, conforming to the dimensions and form indicated on the plans. The construction shall conform to the requirements specified in Section54 (FAA Item P-610). Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is poured.*

All invert channels shall be constructed and shaped accurately so as to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped downward toward the outlet.

751-3.4 PRECAST CONCRETE PIPE STRUCTURES. *Precast concrete pipe structures shall be constructed on prepared or previously placed slab foundations and shall conform to the dimensions and locations shown on the plans. All precast concrete pipe sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily, and all jointing and connections shall be cemented with mortar. The top of the upper precast concrete pipe member shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal steps that are embedded or built into the side walls shall be aligned and placed at vertical intervals of 12 inches. When a metal ladder replaces the steps, it shall be securely fastened into position.*

751-3.5 CORRUGATED METAL STRUCTURES. *Corrugated metal structures shall be constructed on prepared foundations, conforming to the dimensions and locations as shown on the plans. The structures shall be prefabricated. standard or special fittings shall be furnished to provide pipe connections or branches of correct dimensions. The connections or branches shall be of sufficient length to*

accommodate connecting bands. The fittings shall be welded in place to the metal structures. When indicated, the structures shall be placed on a reinforced concrete base. The top of the metal structure shall be designed so that either a concrete slab or metal collar may be attached to which can be fastened a standard metal frame and grate or cover. Steps or ladders shall be furnished as shown on the plans.

751-3.6 INLET AND OUTLET PIPES. *Inlet and outlet pipes shall extend through the walls of the structures for a sufficient distance beyond the outside surface to allow for connections but shall be cut off flush with the wall on the inside surface, unless otherwise directed. For concrete or brick structures, the mortar shall be placed around these pipes so as to form a tight, neat connection.*

751-3.7 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES, AND FITTINGS. *All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the Engineer, and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.*

When frames or fittings are to be placed upon previously constructed masonry, the bearing surface or masonry shall be brought true to line and grade and shall present an even bearing surface in order that the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed and approved by the Engineer. All units shall set firm and secure.

After the frames or fittings have been set in final position and the concrete or mortar has been allowed to harden for 7 days, then the grates or covers shall be placed and fastened down.

751-3.8 INSTALLATION OF STEPS. *The steps shall be installed as indicated on the plans or as directed by the Engineer. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is poured. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least 7 days. After this period has elapsed, the steps shall be cleaned and painted, unless they have been galvanized.*

When steps are required with precast concrete pipe structures, they shall be cast into the sides of the pipe at the time the pipe sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches.

In lieu of steps, prefabricated ladders may be installed. In the case of brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. In the case of metal structures, the ladder shall be secured by welding the top support and grouting the bottom support into drilled holes in the foundation or as directed.

751-3.9 BACKFILLING.

a. *After a structure has been completed, the area around it shall be filled with approved material, in horizontal layers not to exceed 8 inches in loose depth, and compacted to the density required in Section 23 Earthwork (FAA Item P-152). Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the Engineer.*

b. *Backfilling shall not be placed against any structure until permission is given by the Engineer. In the case of concrete, such permission shall not be given until the concrete has been in place 7 days, or until tests made by the laboratory under supervision of the Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.*

c. *Backfill shall not be measured for direct payment. Performance of this work shall be considered on obligation of the Contractor covered under the contract unit price for the structure involved.*

751-3.10 CLEANING AND RESTORATION OF SITE. *After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Engineer. The Contractor shall restore all disturbed areas to their original condition.*

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 *See Section 58-**[4][5]***

BASIS OF PAYMENT

751-5.1 *See Section 58-**[5][6]***

MATERIAL REQUIREMENT

ASTM A 27	*Steel Castings, Carbon, for General Application*
ASTM A 47	*Ferritic Malleable Iron Castings*
ASTM A 48	*Gray Iron Castings*
ASTM A 123	*Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
ASTM A 283	*Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars*
ASTM A 536	*Ductile Iron Castings*
ASTM A 897	*Austempered Ductile Iron Castings*
ASTM C 32	*Sewer and Manhole Brick (Made from Clay or Shale)*
ASTM C 144	*Aggregate for Masonry Mortar*
ASTM C 150	*Portland Cement*
ASTM C 478	*Precast Reinforced Concrete Manhole Sections*
AASHTO M 36	*Zinc Coated (Galvanized) Corrugated Iron or Steel Culverts and Underdrains*

END OF ITEM D-751

ITEM D-752 CONCRETE CULVERTS, HEADWALLS, AND MISCELLANEOUS DRAINAGE STRUCTURES

DESCRIPTION

752-1.1 *This item shall consist of [plain][reinforced] concrete culverts, headwalls, and miscellaneous drainage structures constructed in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.*

MATERIALS

752-2.1 CONCRETE. *Plain or reinforced concrete shall meet the requirements of Section 54..*

CONSTRUCTION METHODS

752-3.1 UNCLASSIFIED EXCAVATION.

a. *Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the plans. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. All soft and unsuitable material shall be removed and replaced with suitable approved material. A layer of Processed Miscellaneous Base, conforming to Section 200-2.5 of the 2009 Standard Specifications for Public Works Construction (Greenbook) shall be placed and compacted to the thickness indicated on the plans, to form a subbase Compaction shall be to 90% of D1557. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximate only; and the Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.*

b. *Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing steel is to be placed.*

c. *The Contractor shall do all bracing, sheathing, or shoring necessary to perform and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for excavation.*

d. *Unless otherwise provided, bracing, sheathing, or shoring involved therewith shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished concrete. The cost of removal shall be included in the unit price bid for excavation.*

e. *After each excavation is completed, the Contractor shall notify the Engineer to that effect, and concrete or reinforcing steel shall be placed after the Engineer has approved the depth of the excavation and the character of the foundation material.*

752-3.2 BACKFILLING.

a. *After a structure has been completed, backfilling with approved material shall be accomplished by applying the fill in horizontal layers not to exceed 8 inches in loose depth, and compacted. The field density of the compacted material shall be at least 90 percent of the maximum density for cohesive soils and 95 percent of the maximum density for noncohesive soils. The maximum density shall be determined in accordance with ASTM D 1557. The field density shall be determined in accordance with ASTM D 1556.*

b. *No backfilling shall be placed against any structure until permission is given by the Engineer. In the case of concrete, such permission shall not be given until the concrete has been in place 7 days, or until tests made by the laboratory under the supervision of the Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.*

c. *Fill placed around concrete culverts shall be deposited on both sides at the same time and to approximately the same elevation. Care shall be taken to prevent any wedging action against the structure, and all slopes bounding or within the areas to be backfilled shall be stepped or serrated to prevent wedge action.*

d. *Backfill will not be measured for direct payment. Performance of this work under the contract is not payable directly but shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for ``unclassified excavation for structures.''*

752-3.3 WEEP HOLES. *Weep holes shall be constructed as shown on the plans.*

752-3.4 CLEANING AND RESTORATION OF SITE. *After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulders, or as*

ordered by the Engineer. The Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

752-4.1 *See Section 58-**[4][5]***

BASIS OF PAYMENT

752-5.1 *See Section 58-**[5][6]***

TESTING REQUIREMENTS

ASTM D 1557	*Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-in (305 mm) Drop*
ASTM D 1556	*Density of Soil in Place by the Sand-Cone Method*

END OF ITEM D-752

ITEM D-754 CONCRETE GUTTERS, DITCHES, AND FLUMES

DESCRIPTION

754-1.1 *This item shall consist of portland cement concrete gutters, ditches, and flumes constructed in accordance with these specifications at the specified locations in accordance with the dimensions, lines, and grades as shown on the plans.*

MATERIALS

754-2.1 *Concrete, plain and reinforced concrete shall meet the requirements of Section 54 of these specifications.*

754-2.2 JOINTS. *Joint filler materials and premolded joint material shall conform to Section 42 of these specifications.*

CONSTRUCTION METHODS

754-3.1 PREPARING SUBGRADE. *Excavation shall be made to the required width and depth, and the subgrade upon which the item is to be built shall be compacted to a firm uniform grade. All soft and unsuitable material shall be removed and replaced with suitable approved material. All soft and unsuitable material shall be removed and replaced with suitable approved material. A layer of Processed Miscellaneous Base, conforming to Section 200-2.5 of the 2009 Standard Specifications for Public Works Construction (Greenbook) shall be placed and compacted to the thickness indicated on the plans, to form a subbase Compaction shall be to 90% of D1557. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started.*

754-3.2 PLACING. *The forms for and the mixing, placing, finishing, and curing of concrete shall conform to the requirements of Item P-610 and shall be in accordance with the following requirements.*

The concrete shall be tamped and spaded until it is consolidated and mortar entirely covers and forms the top surface. The surface of the concrete shall be floated smooth and the edges rounded to the radii shown on the plans. Before the concrete is given the final finishing, the surface shall be tested with a 10-foot straightedge, and any irregularities of more than 1/4 inch in 10 feet shall be eliminated.

The concrete shall be placed with dummy-grooved joints not to exceed 25 feet apart, except where shorter lengths are necessary for closures, but no section shall be less than 4 feet long.

Expansion joints of the type called for in the plans shall be constructed to replace a dummy groove at spacings of approximately 100 feet. When the gutter is placed next to concrete pavement, expansion joints in the gutter shall be located opposite expansion joints in the pavement. When a gutter abuts a pavement or other structure, an expansion joint shall be placed between the gutter and the other structure.

Forms shall not be removed within 24 hours after the concrete has been placed. Minor defects shall be repaired with mortar containing 1 part cement and 2 parts fine aggregate.

The operations of depositing, compacting, and finishing the item shall be conducted so as to build a satisfactory structure. If any section of concrete is found to be porous, other than minor defects that may be plastered, or is otherwise defective, it shall be removed and replaced by the Contractor without additional compensation.

754-3.3 BACKFILLING. *After the concrete has set sufficiently, the spaces adjacent to the structure shall be refilled to the required elevation with material specified on the plans and compacted by mechanical equipment to at least 90% of the maximum density as determined by ASTM D 1557. The in-place density shall be determined in accordance with ASTM D 1556.*

754-3.4 CLEANING AND RESTORATION OF SITE. *After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Engineer. The Contractor shall restore all disturbed areas to their original condition.*

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear and in good condition.

Performance of the work described in this section is not payable directly but shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for the structure.

METHOD OF MEASUREMENT

754-4.1 *See Section 58-**[4][5]***

BASIS OF PAYMENT

754-5.1 *See Section 58-[5][6]*

TESTING REQUIREMENTS

ASTM D 1557	*Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-inch (300 mm) Drop*
ASTM D 1556	*Density of Soil in Place by the Sand-Cone Method*

END OF ITEM D-754

58-2 ADJUST MISCELLANEOUS STRUCTURES TO GRADE.

Manholes, inlets, outlets, handholes, and other structures and other utilities identified on the plans to be adjusted to grade shall be done in accordance with the details and standard specification references shown on the plans. Where no specific details are called out, the Contractor's method of adjusting the grade of the structure shall be submitted to, and approved by, the Engineer prior to proceeding with the work. All adjustments shall be capable of supporting the aircraft load in Section 751-2.8.

Utility systems on lines where manholes, handholes and other structures to be modified or adjusted to grade will be required to be tested after the completion of the work. No modification or adjustment will be accepted for payment until such testing is completed and approved by the Engineer.

The Contractor shall be solely responsible for all coordination with affected utility or owner agencies where adjustments to access structures are required. This shall include FAA, fuel companies, telephone and other utility companies. No modifications to the schedule will be allowed for delays due to the failure on the part.

58-3 [OTHER DRAINAGE SYSTEM WORK]

[Description]

58-[4][5] METHOD OF MEASUREMENT

Manholes, catch basins, inlets, [ ] and other utility structures shall be measured by the unit, completed and accepted by the Engineer.

58-[5][6] BASIS OF PAYMENT

The accepted quantities of manholes, catch basins, inlets, [ ] and inspection holes will be paid for at the contract unit price per each in place when completed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and

placing of the materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor equipment, tools and incidentals necessary to complete the structure.

No separate payment will be made for constructing the items under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

Item 58.1	**[Manhole] [Catch Basin] [Other]**	per each
Item 58.2	Adjust **[ ]** to Grade	per each
Item 58.3	[Other]	per [each][linear foot][lump sum]

END OF SECTION 58

SECTION 62– PAVEMENT MARKING, CLOSURE MARKINGS, MARKERS, SIGNS, AND CONSTRUCTION FENCING

62-1 GENERAL

Under this section, the Contractor shall perform all work required by the plans for the application of pavement marking paint to taxiways, runways, roads, infield areas and other pavement in accordance with Section 310 5.6 of the Standard Specifications, except as specified otherwise in FAA Specification Item P 620, as included and modified hereafter, and as shown on the Plans.

Under this section, the Contractor shall provide also **[temporary taxiway closure markings,] [pavement reflective markers,] [temporary road and taxiway signs,] [construction area fencing,] [weighted barricades,] [lighted "X" runway closure markers,]** and all other incidentals, as shown on the Plans, and as required to accommodate the sequencing of the construction as the project progresses, including moving items from one phase to another phase.

ITEM P-620 RUNWAY AND TAXIWAY PAINTING

DESCRIPTION

620-1.1 *This item shall consist of the painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer.*

MATERIALS

620-2.1 MATERIALS ACCEPTANCE. *The Contractor shall furnish manufacturer's certified test reports for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. The reports can be used for material acceptance or the Engineer may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the Engineer upon arrival of a shipment of materials to the site.*

620-2.2 PAINT. *Paint shall be Waterborne, paint manufactured by Morton, or approved equal. Colors shall be as listed below:*

White: 37925 (Morton #2600A9)
Yellow: 33538 or 33655 (Morton #2601A9)
Black: 3-103e
Green: Morton #2594A9

a. WATERBORNE. *Paint shall meet the requirements of Federal Specification TT-P-1952E, Type I.*

b. EPOXY. Section not used.

c. METHACRYLATE. Section not used.

d. SOLVENT-BASE. Section not used.

[e. PREFORMED THERMOPLASTIC AIRPORT PAVEMENT MARKINGS*. Markings must be composed of ester modified resins in conjunction with aggregates, pigments, and binders that have been factory produced as a finished product. The material must be impervious to degradation by aviation fuels, motor fuels, and lubricants.*

(1) *The markings must be able to be applied in temperatures down to 35°F without any special storage, preheating, or treatment of the material before application.*

(2) Graded Glass Beads.

(a) *The material must contain a minimum of thirty percent (30%) intermixed graded glass beads by weight. The intermixed beads shall conform to* ***[Federal Specification. TT-B-1325D, Type I, gradation A] [Federal Specification. TT-B-1325D, Type IV]****.*

(b) *The material must have factory applied coated surface beads in addition to the intermixed beads at a rate of 1 lb. (± 10%) per 10 sq. ft. These factory-applied coated surface beads shall have a minimum of 90% true spheres, minimum refractive index of 1.50, and meet the following gradation.*

Size Gradation US Mesh	µm	Retained, %	Passing, %
12	1700	0 - 2%	98 - 100%
14	1400	0 - 3.5%	96.5 - 100%
16	1180	2 - 25%	75 - 98%
18	1000	28 - 63%	37 - 72%
20	850	63 - 72%	28 - 37%
30	600	67 - 77%	23 - 33%
50	300	89 - 95%	5 - 11%
80	200	97 - 100%	0 - 3%

(3) Heating

Indicators. *The top surface of the material (same side as the factory applied surface beads) shall have regularly spaced indents. These indents shall act as a visual cue during application that the material has reached a molten state so satisfactory adhesion and proper bead embedment has been achieved and a post-application visual cue that the installation procedures have been followed.*

(4) Pigments. *Percent by weight.*

(a) White: *Titanium Dioxide, ASTM D 476, type II shall be 10 percent minimum.*

(b) Yellow and Colors: *Titanium Dioxide, ASTM D 476, type II shall be 1 percent minimum.*

Organic yellow, other colors, and tinting as required to meet color standard.

(5) Prohibited Materials. *The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.*

(6) Daylight Directional Reflectance.

(a) White: *The daylight directional reflectance of the white paint shall not be less than 75 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141D/GEN, Method 6121.*

(b) Yellow: *The daylight directional reflectance of the yellow paint shall not be less than 45 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141D/GEN. The x and y values shall be consistent with the Federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:*

x .462 x .470 x .479 x .501

y .438 y .455 y .428 y .452

(7) Skid Resistance. *The surface, with properly applied and embedded surface beads, must provide a minimum resistance value of 45 BPN when tested according to ASTM E303.*

(8) ***Thickness.*** *The material must be supplied at a nominal thickness of 65 mils (1.7 mm).*

(9) ***Environmental Resistance.*** *The material must be resistant to deterioration due to exposure to sunlight, water, salt, or adverse weather conditions and impervious to aviation fuels, gasoline, and oil.*

(10) ***Retroreflectivity.*** *The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of nighttime retroreflection when tested in accordance to ASTM E1710.*

(11) ***Packaging.*** *A protective film around the box must be applied in order to protect the material from rain or premature aging.*

(12) ***Manufacturing Control and ISO Certification.*** *The manufacturer must be ISO 9001:2000 certified and provide proof of current certification. The scope of the certification shall include manufacture of reflective markings.*

a. *The markings must be a resilient thermoplastic product with uniformly distributed glass beads throughout the entire cross-sectional area. The markings must be resistant to the detrimental effects of aviation fuels, motor fuels and lubricants, hydraulic fluids, de-icers, anti-icers, protective coatings, etc. Lines, legends, and symbols must be capable of being affixed to bituminous and/or Portland cement concrete pavements by the use of a large radiant heater. Colors shall be available as required.*

b. *The markings must be capable of conforming to pavement contours, breaks, and faults through the action of airport traffic at normal pavement temperatures. The markings must be capable of fully conforming to grooved pavements, including pavement grooving per FAA AC 150/5320-12, current version. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastics when heated with a heat source per manufacturer's recommendation.*

c. *Multicolored markings must consist of interconnected individual pieces of preformed thermoplastic pavement marking material, which through a variety of colors and patterns, make up the desired design. The individual pieces in each large marking segment (typically more than 20 ft. long) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a marking segment. Obtaining multicolored effect by*

overlaying materials of different colors is not acceptable due to resulting inconsistent marking thickness and inconsistent application temperature in the marking/substrate interface.

d. *The marking material must set up rapidly, permitting the access route to be re-opened to traffic a maximum of 15 minutes after application.*

e. *The marking material shall have an integral color throughout the thickness of the marking material.**]***

620-2.3 REFLECTIVE MEDIA. *Glass beads shall meet the requirements for Federal Specification. TT-B-1325D, Type I, gradation A. Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.*

CONSTRUCTION METHODS

620-3.1 WEATHER LIMITATIONS. *The painting shall be performed only when the surface is dry and when the surface temperature is at least 45°F and rising and the pavement surface temperature is at least 5°F above the dew point. Painting operations shall be discontinued when the surface temperature exceeds limits recommended by the manufacturer. Markings shall not be applied when the pavement temperature is greater than 120°F.*

620-3.2 EQUIPMENT. *Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the job.*

The mechanical marker shall be an atomizing spray type or airless-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray.

620-3.3 PREPARATION OF SURFACE. *Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other foreign material that would reduce the bond between the paint and the pavement. The area to be painted shall be cleaned by sweeping and blowing or by other methods as required to remove all dirt, laitance, and loose materials without damage to the pavement surface. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the Engineer. Paint shall not be applied to Portland cement concrete pavement until*

the areas to be painted are clean of curing material. Sandblasting or high-pressure water shall be used to remove curing materials.

620-3.4 LAYOUT OF MARKINGS. *The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be shown on the plans or as indicated in the following list:*

1. *All runway and taxiway holding position markings.*
2. *Runway threshold marking.*
3. *Runway threshold bar.*
4. *Runway aiming point marking.*
5. *Runway designation marking.*
6. *Runway touchdown zone markings.*
7. *Runway centerline marking.*
8. *All taxiway centerline markings.*
9. *Geographical position marking.*
10. *Surface painted signs.*
11. *Runway side stripes.*
12. *Taxiway edge markings.*
13. *Non-movement Area boundary markings.*
14. *Displaced threshold markings.*
15. *Demarcation bar.*

620-3.5 APPLICATION. *Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the Engineer. The edges of the markings shall not vary from a straight line more than 1/2 inch in 50 feet and marking dimensions and spacings shall be within the following tolerances:*

Dimension and Spacing	*Tolerance*
36 inches or less	*±1/2 inch*
greater than 36 inches to 6 feet	*± 1 inch*
greater than 6 feet to 60 feet	*± 2 inches*
greater than 60 feet	*± 3 inches*

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate(s) shown in Table 1. The addition of thinner will not be permitted. A period of 30 days shall elapse between placement of a bituminous surface course or seal coat and application of the paint.

Table 1 APPLICATION RATES FOR PAINT, GLASS BEADS, AND SILICA SAND				
Paint Type	*Paint Square feet per gallon, ft2/gal*	*Glass Beads, Type I, Gradation A Pounds per gallon of paint-lb./gal.*	*Glass Beads, Type III Pounds per gallon of paint-lb./gal.*	*Silica Sand Pounds per gallon of paint-lb./gal.*
Waterborne	*115 ft^2/gal. Maximum*	*7 lb./gal minimum*	*N.A.*	*N.A.*

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate(s) shown in Table 1. Glass beads shall not be applied to black paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made.

All emptied containers shall be returned to the paint storage area for checking by the Engineer. The containers shall not be removed from the airport or destroyed until authorized by the Engineer.

[620-3.6 APPLICATION--PREFORMED AIRPORT PAVEMENT MARKINGS.

a. Asphalt and Portland cement *To ensure minimum single-pass application time and optimum bond in the marking/substrate interface, the materials must be applied using a variable speed self-propelled mobile heater with an effective heating width of no less than 16 feet and a free span between supporting wheels of no less than 18 feet . The heater must emit thermal*

radiation to the marking material in such a manner that the difference in temperature of 2 inch wide linear segments in the direction of heater travel must be within 5 percent of the overall average temperature of the heated thermoplastic material as it exits the heater. The material must be able to be applied at ambient and pavement temperatures down to 35ºF without any preheating of the pavement to a specific temperature. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry, and free of debris. A non-VOC sealer with a maximum applied viscosity of 250 centi-Poise (ASTM D 2393) must be applied to the pavement shortly before the markings are applied. The supplier must enclose application instructions with each box/package.]

620-3.[6][7] PROTECTION AND CLEANUP. *After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose or unadhered reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the Engineer. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and Federal environmental statutes and regulations.*

METHOD OF MEASUREMENT

620-4.1 *See Section 62-[8]*

BASIS OF PAYMENT

620-5.1 *See Section 62-[9]*

TESTING REQUIREMENTS

ASTM C 136	*Sieve Analysis of Fine and Coarse Aggregates*
ASTM C 146	*Chemical Analysis of Glass Sand*
ASTM C 371	*Wire-Cloth Sieve Analysis of Nonplastic Ceramic Powders*

ASTM D 92	*Test Method for Flash and Fire Points by Cleveland Open Cup*
ASTM D 711	*No-Pick-Up Time of Traffic Paint*
ASTM D 968	*Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive*
ASTM D 1213-54(1975)	*Test Method for Crushing Resistance of Glass Spheres*
ASTM D 1652	*Test Method for Epoxy Content of Epoxy Resins*
ASTM D 2074	*Test Method for Total Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method*
ASTM D 2240	*Test Method for Rubber Products-Durometer Hardness*
ASTM G 15453	*Operating Light and Water-Exposure Apparatus (Fluorescent Light Apparatus UV-Condensation Type) for Exposure of Nonmetallic Materials.*
Federal Test Method Standard No. 141D/GEN	*Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing*

MATERIAL REQUIREMENTS

ASTM D 476	*Specifications for Dry Pigmentary Titanium Dioxide Pigments Products*
Code of Federal Regulations	*40 CFR Part 60, Appendix A – Definition of Traverse Point Number and Location*
Code of Federal Regulations	*29 CFR Part 1910.1200 – Hazard Communications*
FED SPEC TT-B-1325D	*Beads (Glass Spheres) Retroreflective*
AASHTO M 247	*Glass Beads Used in Traffic Paints*
FED SPEC TT-P-1952E	*Paint, Traffic and Airfield Marking, Waterborne*

Commercial Item Description (CID) A-A-2886B Paint, Traffic, Solvent Based

FED STD 595 Colors used in Government Procurement

END OF ITEM P-620

[DELETE / RENUMBER FOLLOWING SECTIONS AS APPROPRIATE FOR THE PROJECT:]

62- 2 ROAD PAVEMENT MARKINGS

All road pavement markings shall conform to Sections 210 1.6 and 310 5.6 of the Standard Specifications.

62-3 CONSTRUCTION BARRICADES

The Contractor shall provide and maintain barricades of the types shown on the plans. Barricades shall be low-profile, water-filled construction barricades**[, or Caltrans Type 1 Lighted barricades,]** and shall be used to delineate airfield pavement work area limits for the project. Standard weighted wooden barricades will not be allowed for airfield pavement construction area delineation. Location of barricades shall be as shown on the plans or as approved by the Engineer and **[Los Angeles International][ ]** Airfield Operations.

Barricades shall be Low Profile Type 1, water-filled barricades. The Type 1 barricades shall be furnished in with orange and white reflective striping on two sides. They shall be constructed of resiliently deformable and frangible material, designed as modular, interlocking units, which will easily assemble, disassemble, and nest for compact storage. Barricade shape shall be low enough so as to not interfere with taxiing aircraft. The Type 1 barricade shall be furnished in alternating orange and white and will be installed so that the colors alternate on adjacent barricades. Each 96" length of barricade shall be equipped with at least one red omni-directional steady burning light. Barricades shall meet the minimum requirements of FAA AC 150/5370-2E, Operational Safety on Airports During Construction. Barricades will be Multi-Barrier Safety Barricade Model AR24x96 HDPE SPN or approved equal.

Caltrans Type 1 lighted barricades shall conform to Caltrans Type 1 requirements.

Barricades for road work shall be as detailed on the plans.

Maintenance of the barricades and flashers will be the sole responsibility of the Contractor. No additional payment will be made for maintaining and moving barricades to accommodate the phasing.

62-4 TEMPORARY CONSTRUCTION BARRICADE FENCING

The Contractor shall provide and maintain construction barricade fencing to delineate work area limits for each construction phase. Location of barricade fencing shall be approved by the Engineer and Los Angeles International Airfield Operations. The fencing lines are intended as a safety device to aid the Contractor's workers and subcontractors in easily delineating areas of the airport which are off limits from those areas approved for his work activities. Fencing shall be 36" high, orange temporary safety fence, Tensar Easy Gardener BX 205116, or approved equal. Posts, excavation, backfill, and all other incidentals necessary for complete fencing installation, as detailed on the Plans and as approved by the Engineer, shall be included in this item, including periodic relocation as may be needed to accommodate construction phasing.

62-5 TEMPORARY PAVEMENT MARKINGS AND REMOVALS

Temporary pavement markings required to accommodate aircraft and vehicle traffic shall also be a portion of temporary work and will be measured for payment as Runway and Taxiway Painting. In order to accommodate the various phasing requirements of the Plans, or for other reasons, the Contractor will be required to remove pavement markings at various locations as the construction proceeds, as indicated on the Plans and as specified in Section 14 of these Specifications.

62-6 TRAFFIC SIGNS

The Contractor shall provide 16 gauge aluminum traffic signs, with reflectorized faces and legends, for **["Stop" signs,] ["Stop for Aircraft" signs,][other]** and **[Taxiway Designation]** signs as shown on the Plans. Sizes, materials, and mounting methods shall be as indicated on the Plans. Posts, excavation, backfill, and all other incidentals necessary for complete signs as detailed on the Plans and as approved by the Engineer shall be included in this item, including periodic relocation as may be needed to accommodate construction phasing.

62-7 LIGHTED "X" RUNWAY CLOSURE MARKERS

Under this section the Contractor shall supply [four (4)] two (2)] lighted runway closure markers to indicate to inbound aircraft that the marked runway is closed. Contractor shall provide and maintain the equipment during the project construction period, but they shall become the property of the Airport and delivered to the Airport Maintenance Yard by the Contractor upon completion of the work. Each marker shall be provided with a generator power unit, but during the progress of the project they are to be wired to temporary power cables. The generator power supply shall be used only in
emergencies.

The units shall be manufactured by Hali-Brite, RXM or approved equal and shall consist of an all weather sign panel and illuminated "X" with indicators capable of being visible from a distance of up to five miles. The units shall contain their own power-generating systems sufficient for total operation in a stationary stable position.

Lighted Xs shall meet the following requirements:

A. The portable runway closure marker shall be designed to form a lighted X which contains twenty-one (21) 90-watt par 38, 10-degree weather proof outdoor standard base clear Halogen spot bulbs with one (1) bulb located in the center and five (5) bulbs located in each of the four (4) legs. All X panel bulbs, light sockets, wiring and connections shall be enclosed in a weather resistant housing.

B. The lighted X formed when opened and operating shall be 20 feet 6 inches each continuous leg and 14 feet 6 inches on the peripheral.

C. The marker shall collapse for transport and storage so that all parts are inside the trailer frame dimensions to prevent damage.

D. Illumination of the marker shall be workable in a continuous or flashing mode. This shall be controlled by a solid state flasher. Mechanical flashers are not acceptable.

E. A photo cell shall be used to reduce the voltage to 75 volts for nighttime operations.

F. Flash interval time shall be:

(1) Bright Mode: Approximately 2.5 seconds on and 2.5 seconds off.

(2) Dim Mode: Approximately 2.5 seconds on and 2.5 seconds off.

G. A radio interference filter shall be installed with a operation frequency of 50 Hz.

H. The marker shall have at least two (2) lights (mounted at the backside of the upper portion of the top of the legs of the X) on the backside of the X to indicate power is being supplied to the marker and to indicate that more than one (1) bulb has become inoperative.

I. The marker shall be designed so it can be used while still attached to the tow vehicle or have the means to stand alone.

J. The marker shall be able to withstand winds of 40 MPH (64.37 KPH) while in operational mode. This must be documented.

K. The runway closure marker shall be visible from a distance of 3 to 5 miles VFR daytime and a minimum of 6 miles VFR nighttime. These distances shall be determined from an aircraft using a Loran receiver. Documents substantiating these field tests by an independent third party shall accompany specifications.

L. Set up time for the marker shall be capable of being accomplished by one person in two (2) minutes or less. This means the marker can be raised and operating within this time frame.

M. The marker shall have the fuel capacity to run at full load for a minimum of 120 hours without refueling. Contractor shall be responsible for refueling.

N. The marker shall have the capability of being hard wired for the convenience of operating without the use of a generator for prime power.

O. The marker angle mechanism shall be constructed of 2" (60.96 cm) square tubing, minimum.

P. All electrical components shall be UL listed.

Q. The angle mechanism shall be capable of tilting 3 degrees from vertical and have trailer adjustments to accommodate this angle no matter what the degree of the runway.

R. The angle mechanism shall be operated by an electric actuator which will both raise and lower the mechanism with power from the generator.

S. The marker lighted legs shall be constructed from a lightweight aluminum type material.

T. A locking system shall be installed to secure the legs from expanding when the marker is in the transport mode.

U. The trailer frame shall be constructed from approximately 2" (60.96 cm) square tubing.

V. Trailer dimensions: 7 feet 6 inches wide, 10 feet long.

W. The trailer floor shall be expanded steel to serve as a work platform for servicing personnel and to minimize the possibility of ice and snow accumulation

X. The tires shall be minimum 4.80 X 12" (203.20 X 30.48 cm) tubeless 4-ply tires, 12" (30.48 cm) wheels and be covered with metal type fenders. Shall come with three (3) tires mounted on three wheels (one is for a spare).

Y. A 1,500-pound axle with built-in independent Henschen type suspension or equal. Axle springs, shackles, or shock absorbers are not acceptable.

Z. 2-Inch FAS-LOC coupling rated at 3,500 pounds GVW., with safety chains.

A1. Shall have 3" pintle ring hitch mounted at the rear of the trailer to facilitate towing of a second runway closure marker.

B1. Provisions to accommodate safety chains shall be mounted at the rear of the trailer.

C1. D.O.T. approved brake, tail, and turn signal lights and reflectors shall be provided.

D1. Five (5) 2,000-pound jack stands located at each corner and tongue.

E1. The entire marker unit shall be powder coated gloss to a 1.8 mil minimum dry film thickness. Powder to be outdoor rated, UV resistant, polyester TGIC with the following characteristics:

(1) H-2H Pencil Hardness ASTM-D522.
(2) 160 IN-Lb Gardner direct & reverse impact ASTM-D2794 modified.
(3) Flex over 1/4 dia. needed without fracture.

F1. Diesel Powered Generator:

(1) Rated Watts: Minimum 4,000.
(2) Voltage: 120/240.
(3) Amperage: 29.2/14.6.
(4) Fuel Capacity: 30 Gallons.
(5) Run Time: 120 hours.
(6) Shall comply with Mil Spec. W-F 800 for the use of alternative fuels.
    a. CF-1.

b. CF-2.
c. JET-A.

(7) Starting System: 12V DC Electric & Recoil Rope.

(8) Electrical Outlets:
a. 2-120V (15A) w/ GFI.
b. 1-120V (30A) w/ twistlock.
c. 1-240V (20A).

(9) Other Features:
a. Low Oil Pressure Safety Protection System.
b. Running Time Meter.
c. USDA Forestry Approved Muffler.
d. Circuit Breaker Protection.
e. Anti-Vibration Rubber Mounts.
f. Dry Air Cleaner.
g. 12V Battery Charging System.

G1. Protective Cover

(1) Total Weight: 18 OZ P.S.Y.
(2) Width: 61 inches.
(3) Yarn: Polyester.
(4) Count: 20 by 20.
(5) Denier: 1000D by 1000D.
(6) Grab Tensile (FS 5100): 400 by 338.
(7) Tongue Tear (FS 5134): 77 by 77.
(8) Adhesion (FS 5970): 15 lbs.
(9) Abrasion (FS 5306): 1,000 cycles.
(10) Low Temperature: -40 degrees.
(11) Continuous: 180 degrees.
(12) Intermittent: 200 degrees.
(13) Finish: Matte.
(14) Treatments: Anti-mildew, U.V. pigments.
(15) Putup: 75 yards.

H1. The marker shall have a protective "Sunbrella" or approved equal type storage cover.

I1. Manuals – One (1) operators manual, and one (1) parts manual for each unit shall accompany equipment at time of delivery. Microfiche, computer diskette or CD is acceptable if printed manuals are not available. Manuals to be in English.

J1. Warranty

(1) State terms and conditions of factory warranty. Minimums of one (1) year, to include parts and labor.

(2) Equipment and all components thereof must comply with all Federal, State, and local regulations that may apply at time of delivery.

(3) Vendor shall be responsible to provide LAWA Construction and Maintenance, all applicable service bulletins. These shall be mailed to the same location as the delivery address.

K1. Training/Startup

(1) Vendor shall have training of operation and maintenance provided. Time and location to be determined by LAWA personnel.

(2) Equipment shall be ready for immediate use.

62-[8] METHOD OF MEASUREMENT

The quantity of "Runway and Taxiway Painting" to be paid for shall be the number of square feet of double-coat painting of stripes, numerals, or other markings, applied to pavement at the locations and to the dimensions shown on the plans, and performed in accordance with the specifications and accepted by the Engineer. Both temporary and permanent marking will be measured as "Runway and Taxiway Painting". One square foot of measurement includes two coats of paint over an applicable area. Reflective markers for temporary edge delineation of pavement will not be measured separately for payment, but will be considered incidental to the marking quantity for the painting and no separate payment will be made.

The quantity of Infield Painting (Green) to be paid for shall be the number of square feet of double-coat painting infield areas, applied to pavement at the locations and to the dimensions shown on the plans, and performed in accordance with the specifications and accepted by the Engineer. One square foot of measurement includes two coats of paint over an applicable area.

Road marking to be paid for shall be the number of square feet of double-coat painting infield areas, applied to pavement at the locations and to the dimensions shown on the plans, and performed in accordance with the specifications and accepted by the Engineer. One square foot of measurement includes two coats of paint over an applicable area.

Construction Barricades, Signs and Construction Fencing to Accommodate Phasing will be measured for payment as a single lump sum item, including providing and maintaining barricades, traffic signs and fencing as required by the plans. These items shall be moved to accommodate phasing and shall be maintained at the Contractor's cost, as required by these specifications and to the satisfaction of the Engineer for the duration of the project.

Marking removals will be measured and paid under Section 14 of these Specifications.

Lighted "X" Runway Closure Markers will be measured as the number of closure markers, provided, including operation, relocation and maintenance of the markers during the project, and delivering the items to the Airport at the conclusion of the project.

62-[9] BASIS OF PAYMENT

Payment will be made at the contract unit price per square foot for "Runway and Taxiway Painting" per square foot, whether temporary or permanent, with or without reflective media, which price shall be full compensation for all layout for furnishing all materials, labor, equipment, tools, and incidentals necessary to provide permanent or temporary airfield pavement striping and marking.

Payment will be made at the contract unit price per square foot for "Infield Painting (Green)" per square foot, which price shall be full compensation for all layout for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item. No separate payment will be made for pavement reflective markers as required.

Payment will be made at the contract unit price per square foot for "Road painting per square foot, whether temporary or permanent, which price shall be full compensation for all layout for furnishing all materials, labor, equipment, tools, and incidentals necessary to road painting.

Payment will be made at the contract lump sum price for "Construction Barricades, Signs and Construction Fencing to Accommodate Phasing", which price shall be full compensation for all layout for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete, operate and maintain the items as specified.

Payment will be made at the contract unit price for "Lighted "X" Runway Closure Markers", which price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete, operate, relocate and maintain the item as specified. Markers become the property at LAWA at the conclusion of the project.

No additional payment will be made for difficulties encountered when providing any work under this section in areas of night construction, or in other areas subject to construction phasing restrictions.

Payment will be made under:

Item 62.1	Runway and Taxiway Painting	.....per square foot
Item 62.2	Infield Painting (Green)	.....per square foot
Item 62.3	Road Marking	.....per square foot
Item 62.4	Construction Barricades, Signs and Construction Fencing to Accommodate Phasing	.....per lump sum

Item 62.5 Lighted "X" Runway Closure Markers ..... per each

END OF SECTION 62

SECTION 63 – CHAIN-LINK FENCES (FAA F-162)

63-1 GENERAL

This specification covers the furnishing and installation of chain link fencing and gates, both permanent and temporary, at the locations shown on the plans. The Contractor shall perform all work in accordance with the Standard Specifications, except as specified otherwise in the FAA Specifications, Item F-162, included herein, and as modified herein and as shown on the plans.

ITEM F-162 CHAIN-LINK FENCES

DESCRIPTION

162-1.1 This item shall consist of furnishing and erecting a chain-link fence in accordance with these specifications and the details shown on the plans and in conformity with the lines and grades shown on the plans or established by the Engineer.

MATERIALS

***162-2.1 FABRIC**. The fabric shall be vinyl-coated chain link fabric conforming to ASTM F668 and SSPWC 206-6.3 meeting the following requirements:*

1. *One piece width, 1 in. mesh, 6 gage min. finish (9 gage core).*
2. *Knuckled edge at both selvage.*
3. *PVC coated fabric shall be in conformance with SSPWC Sect. 206-6.3, Class 1.*

***162-2.2 BARBED WIRE.** Barbed wire shall be vinyl-coated barbed wired, conforming to ASTM F 1665, Class 2b, Type II, 11 gage wire, with 4 point aluminum alloy barbs spaced at 3 inches on center.*

162-2.3 POSTS, RAILS AND BRACES.

1. *Tubular members: ASTM F 1043, Schedule 40, galvanized with a zinc coating of not less than 1.8 oz./sq. ft. minimum.*
   a) *Class 1 steel pipe in accordance with ASTM F1083 (Reference SSPWC Sect. 210-3).*

2. *Poly(Vinyl Chloride) (PVC) coating: ASTM F668.*

3. *Vinyl coated accessories: ASTM F 626 accessories, except for tie wires shall comply with ASTM A 1664, Class 2b.*
   - *a) Tension wire: 6 gage high strength steel wire.*
   - *b) Tension rod: As indicated on Drawings.*
   - *c) Stretcher bars: One piece length equal to full height of fabric. Provide one stretcher bar for each end post, and 2 for each corner and pull post.*
   - *d) Stretcher bar bands: Heavy pressed steel to secure stretcher bars to intermediate, corner posts.*
   - *e) Post tops: Steel or malleable iron designed as a weathertight closure cap. Design caps with opening to permit passage of the top rail, when rail is provided.*
   - *f) Wire ties: For tying fabric to line posts, use 6 gage steel wire clips spaced 12 in. o.c. For tying fabric to tension wire use 9 gage hog rings spaced at 24 in. o.c.*
   - *g) Steel bands: 11 gage, 7/8 in. bands at 12 in on center for barrier.*
   - *h) Barbed wire supporting arms: Galvanized steel assembly complete with provision for anchorage to posts and provision for attachment of 3 rows of barbed wire to each arm. Supporting arm may be either attached to posts or integral with post top weather cap. Provide Vee type with 2 arms at 45 deg. to vertical.*

162-2.4 GATES. *Gates frames, fabric and accessories shall conform to the material requirements in paragraphs 162-2.1 – 162-2.3 and shall be of the type and sizes shown on the plans..*

162-2.5 WIRE TIES AND TENSION WIRES*. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type. Tension wire shall be 7-gauge marcelled steel wire with the same coating as the fabric type and shall conform to ASTM A 824.*

All material shall conform to Fed. Spec. RR-F-191/4.

162-6 MISCELLANEOUS FITTINGS AND HARDWARE. *Miscellaneous steel fittings and hardware for use with steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A 153. Barbed wire support arms shall withstand a load of 250 pounds applied vertically to the outermost end of the arm.*

162-2.7 CONCRETE*. Concrete shall be of a commercial grade with a minimum 28-day compressive strength of 2500 psi conforming to Section 54 of these Specifications.*

162-2.8 MARKING. *Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the gauge of the wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.*

CONSTRUCTION METHODS

162-3.1 CLEARING FENCE LINE. *All trees, brush, stumps, logs, and other debris which would interfere with the proper construction of the fence in the required location shall be removed a minimum width of 2 feet on each side of the fence centerline before starting fencing operations. The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction.*

162-3.2 INSTALLING POSTS. *All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the plans.*

Posts should be spaced not more than 10 feet apart and should be set a minimum of 36 inches in concrete footings. The posts holes shall be in proper alignment so that there is a minimum of 3 inches concrete on all sides of the posts.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within 7 days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches. After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

162-3.3 INSTALLING TOP RAILS. *The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.*

162-3.4 INSTALLING BRACES. *Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.*

162-3.5 INSTALLING FABRIC. *The wire fabric shall be firmly attached to the posts and braced in the manner shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than 1 inch or more than 4 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.*

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used and multiple strands of barbed wire stretched thereon to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches or less.

162-3.6 ELECTRICAL GROUNDS. *Electrical grounds shall be constructed at 500-foot intervals. The ground shall be accomplished with a copperclad rod 8 feet long and a minimum of 5/8 inch in diameter driven vertically until the top is 6 inches below the ground surface. A No. 6 solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to the fence construction.*

METHOD OF MEASUREMENT

See Section 63-2.

BASIS OF PAYMENT

See Section 63-3.

MATERIAL REQUIREMENTS

ASTM A 121	*Zinc-Coated (Galvanized) Steel Barbed Wire*
ASTM A 123	*Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*
ASTM A 153	*Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
ASTM A 392	*Zinc-Coated Steel Chain-Link Fence Fabric*
ASTM A 491	*Aluminum-Coated Steel Chain-Link Fence Fabric*

ASTM A 572	*High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Steel Quality*
ASTM A 653	*Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*
ASTM A 824	*Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence*
ASTM A 1011	*Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability*
ASTM B 117	*Standard Practice for Operating Salt Spray (Fog) Apparatus*
ASTM B 221	*Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire Shapes and Tubes*
ASTM B 429	*Aluminum-Alloy Extruded Structural Pipe and Tube*
ASTM F 668	*Poly(vinyl Chloride)(PVC) and other Organic Polymer-Coated Steel Chain-Link Fence Fabric*
ASTM F 1043	*Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework*
ASTM F 1083	*Pipe, Steel, Hot-Dipped Zinc-coated (galvanized) Welded, for Fence Structures*
ASTM F 1183	*Aluminum Alloy Chain Link Fence Fabric*
ASTM F 1345	*Zinc-5% Aluminum-Mischmetal Alloy-Coated Steel Chain Link Fence Fabric*
ASTM G 152	*Operating Open Flame (Carbon-Arc) Light Apparatus for Exposure of Nonmetallic Materials*
ASTM G 153	*Operating Enclosed Carbon-Arc Light Apparatus for Exposure of Nonmetallic Materials*
ASTM G 154	*Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*

ASTM G 155	*Operating (Xenon- Arc) Light Apparatus for Exposure of Nonmetallic Materials*
FED SPEC	*Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) RR-F-191/3*
FED SPEC	*Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) RR-F-191/4*

END OF ITEM F-162

63-2 METHOD OF MEASUREMENT

Permanent Chain-link Fencing required for this project will be measured for payment by the linear foot of completed and accepted fencing.

Temporary Chain-link Fencing required for this project will be measured for payment by the linear foot of completed and accepted fencing, including removal and restoration of the site to its original condition, including backfill and compaction of post holes.

Gates will not be measured separately but will be measured and paid in the linear footage of associated fencing.

63-3 BASIS OF PAYMENT

Fencing will be paid at the contract unit price per linear foot of the type indicated, which price shall be full compensation for all layout for furnishing all materials, labor, equipment, tools, and incidentals necessary to install and complete the item. For temporary fencing, the removal of the fence, including restoration of the site, is considered an incidental cost and no separate payment will be made.

Gates will be not be paid separately but will be included in the bid price for the associated fencing.

Payment will be made under:

Item 63.1 Chain-link Fence.....per linear foot

[Item 63.2 Temporary Chain-link Fence .....per linear foot]

END OF SECTION 63

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SECTION 64 – SEEDING (FAA T-901 MODIFIED)

64-1 GENERAL

The Contractor shall perform all work in accordance with the Standard Specifications, except as specified otherwise in the FAA Specifications, Item T-901, Seeding, as modified herein and as shown on the plans. Seeding shall be applied using the wet method (Hydroseeding) as described herein. Dry method application will not be allowed.

ITEM T-901 – SEEDING

DESCRIPTION

901-1.1 This item shall consist of soil preparation, seeding, and fertilizing the areas shown on the Plans or as directed by the Engineer in accordance with these specifications.

MATERIALS

901-2.1 SEED. The species and application rates of grass, legume, and cover-crop seed furnished shall be those stipulated herein. Seed shall conform to the requirements of Fed. Spec. JJJ-S-181.

Seed shall be furnished separately or in mixtures in standard containers with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Engineer duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within 6 months of date of delivery. This statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed.

Seed shall be spread in a slurry composed of commercial Seed, Fertilizer, Wood Fiber/Mulch, and a Binder/Tackifier.

Fiber/Mulch shall comply with Section 212-1.2.4 of the Standard Specifications for Type 1 Organic Mulch. Binder/Tackifier shall be a commercially prepared material specifically manufactured as an emulsifying agent for hydroseeding installation. Slurry components shall be combined and applied at the following rates:

Botanical Name (Common Name)	Percent Germination (Minimum)	Pounds Per Acre (Slope Measurement)

Sheep Fescue (Festuca Ovina)	80	25# Live Seed
Zorro Annual Fescue (Festuca Megalura Zorro)	80	25# Live Seed
Lotus scoparious (Deerweed)	40	4.0# Live Seed
Trifolium wildenovii (Tom Cat Clover)	45	3.6# Live Seed
Wood Fiber / Mulch	N/A	1,500#
Binder / Tackifier	N/A	100#
Vulpia microstachys (Small Sixweeks grass) or *Vulpia Myuros (Rattail Sixweeks grass)*	N/A	35.0
Eschscholzia Californica (California Poppy)	N/A	8.0

Seeding shall be performed during the period between November and April inclusive, unless otherwise approved by the Engineer.

901-2.2 FERTILIZER. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified herein, and shall meet the requirements of Fed. Spec. O-F-241 and applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
c. A granular or pellet form suitable for application by blower equipment.
Fertilizers shall be 0 percent nitrogen, 36 percent phosphoric acid, and 19 percent water soluble potash commercial fertilizer and shall be spread at the rate of 326 pounds per acre.

901-2.3 SOIL FOR REPAIRS. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the Engineer before being placed.

CONSTRUCTION METHODS

901-3.1 ADVANCE PREPARATION AND CLEANUP. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris which might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches as a result of grading operations and, if immediately prior to seeding, the top 3 inches of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

However, when the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches. Clods shall be broken and the top 3 inches of soil shall be worked into a satisfactory seedbed by discing, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

901-3.2 DRY APPLICATION METHOD. Section not used.

901-3.3 WET APPLICATION METHOD

a. **General**. The Contractor shall apply seed and fertilizer by spraying them on the previously prepared seedbed in the form of an aqueous mixture of the materials described above, and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.

b. Spraying Equipment. The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 pounds per square inch. The pump shall be mounted in a line which will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipe lines shall be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from 20 to 100 feet. One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet in length shall be provided to which the nozzles may be connected.

c. **Mixtures**. Seed, fertilizer, mulch and binder shall be mixed together in the relative proportions specified, but not more than a total of 220 pounds of these combined solids shall be added to and mixed with each 100 gallons of water.
All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. Brackish water shall not be used at any time. The Contractor shall identify to the Engineer all sources of water at least 2 weeks prior to use. The Engineer may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source which is disapproved by the Engineer following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within 2 hours from the time they were mixed or they shall be wasted and disposed of at locations acceptable to the Engineer.

d. **Spraying.** Mixtures of seed, fertilizer, mulch and binder shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray which shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to insure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area. Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces which are to be mulched as indicated by the Plans or designated by the Engineer, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

901-3.4 MAINTENANCE OF SEEDED AREAS. The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Engineer. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow, water and otherwise maintain seeded areas in a satisfactory condition and as directed until final inspection and acceptance of the work. The contractor shall water the seeding mix twice every night from the runway/taxiway edge at night for a period of time beginning when the seed is placed to a period of time that shall end 1 week after the grass is ½" tall as measured from the root level.

When either the dry or wet application method outlined above is used it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the Engineer. If at the time when the contract has been otherwise completed it is not possible to make an adequate determination of the color, density, and uniformity of such stand of grass, payment for the unaccepted portions of the areas seeded will be withheld until such time as these requirements have been met.

METHOD OF MEASUREMENT

901-4.1 See Section 64-2.

BASIS OF PAYMENT

901-5.1 See Section64-3.

MATERIAL REQUIREMENTS

ASTM D 977	*Emulsified Asphalt*
Fed. Spec. JJJ-S-181B	*Agricultural Seeds*

Fed. Spec. O-F-241D	*Commercial Mixed Fertilizer*

END OF ITEM T-901

64-2 METHOD OF MEASUREMENT

The quantity of seeding to be paid for shall be the number of seeded acres, measured on the ground surface, completed and accepted. Measurement shall be to the nearest 1/10 acre.

64-3 BASIS OF PAYMENT

Payment will be made at the contract unit price per acre or fraction thereof, of completed and accepted seeding, which price shall be full compensation for furnishing all materials, including seed, fertilizer, mulch, binder, water, and maintenance, for all preparation, placing of these materials, and for all labor, equipment, tools and all incidentals necessary to complete this item.

Payment will be made under:

Item 64.1 Seeding.....per acre

END OF SECTION 64

SECTION 68 – AIRFIELD ELECTRICAL WORK

68-1 GENERAL

68-1.1 Description.

The Electrical work to be done under this contract shall include the furnishing of all supervision, labor, materials, tools, equipment and incidentals necessary to install remove, and modify taxiway and runway lighting, taxiway and runway internally illuminated signage, power supply, cabling and electrical conduit and all other electrical work shown on the drawings, as specified herein and in accordance with Federal Aviation Administration Advisory Circular No. 150/5370-10, latest version, "Standards for specifying Construction of Airports," other FAA Advisory Circulars and Specification referred to herein, the Standard Specifications for Public Works Construction as modified herein, and other requirements as specified herein.

The Electrical Contractor and the Electrical Job Superintendent shall be required to have at least 5 years of verifiable experience with installing and modifying airfield electrical systems in order to work on this project. The qualified Electrical Job Superintendent shall be on-site providing supervision of the actual electrical installation when electrical work in occurring.

The Contractor shall obtain and pay for all electrical inspections and permits required. All electrical materials, equipment, assemblies and workmanship shall conform to the requirements of the City of Los Angeles Electrical Code, Latest Edition.

Before any electrical equipment is ordered, the Contractor shall furnish the Engineer a list of the equipment and materials he plans to incorporate in the work. This list shall include the name of each item, the Federal Aviation Administration Specification Number, the manufacturer's name, the manufacturer's catalog number, and the size, type and/or rating of each item.

After the list has been approved, the Contractor shall assemble the equipment and materials at a single location and request inspection by the Engineer. None of the equipment or material, other than duct or conduit, may be used on the job until such an inspection has been completed.

All work shall be performed in strict accordance with these contract specifications, and drawings and any instructions as may be furnished by the Engineer during execution of the work to aid in interpretation of said drawing, and specifications. Installation details and material and equipment specifications shall be in conformance with all applicable FAA advisory circulars. Only airport lighting equipment that is listed on the latest edition of the FAA approved list AC 150/5345-53 shall be acceptable for use on this contract. All other equipment and materials covered by other referenced specifications shall be UL approved labeled by a City

of Los Angeles Recognized Electrical Testing Agency and subject to acceptance through manufacturer's certification of compliance with applicable specification. The Contractor shall furnish written proof of FAA approval on all equipment covered by FAA specifications.

See the following sections for related airfield electrical work:

Section 69 - Airport Underground Cable (FAA L-108)
Section 70 - Airport Transformer Vault and Vault Equipment (FAA L-109)
Section 71 - Airport Underground Electrical Duct and Pullboxes (FAA L-110)
Section 72 - Electrical Manholes and Junction Structures (FAA L-115)

The following electrical equipment shall conform to the following FAA specifications. The Contractor shall have and maintain the most current version of these Specifications in his files:

FAA SPECIFICATION	**ITEM**
L-804	Runway Guard Light (Wig-Wag) (Elevated)
L-804E	Runway Guard Light, Quartz (Elevated)
L-850A	Runway Centerline Light (In-Pavement)
L-850B	Runway Touchdown Zone Light (In-Pavement)
L-850C	Runway Edge Light, Quartz (In-Pavement)
L-852C	Taxiway Centerline Light, LED (In-Pavement)
L-852D	Taxiway Centerline Light, LED (In-Pavement)
L-852E	Taxiway Edge Light, LED (In-Pavement)
L-852G	Runway Guard Light, LED (In-Pavement)
L-852T	Taxiway Edge Light, LED (In-Pavement)
L-858Y, R, L, B	Sign Unit
	1 Module
	2 Module
	3 Module
	4 Module
	5 Module
L-861T	Taxiway Edge Light LED (Elevated)
L-862	Runway Edge Light, Quartz (Elevated)

68-1.2 Summary of Work

The work to be performed shall include furnishing all labor, supplies, materials, equipment, plant, transportation, and services required to augment, move, install, and complete electrical work as specified herein and as shown on the contract.

This work includes but is not limited to the following:

A. Maintain in operation all existing field electrical facilities and circuits while this improvement work is in progress, including protection of airport personnel, aircraft and vehicles; furnish and maintain temporary circuits, and place augmented airport lighting into operation. Field lighting on active runways and taxiways shall be operable each night, each day when fog conditions exist, or when the airport calls an emergency.

B. Furnish, install, test and tag underground cable (L-824) in accordance with specifications. Excavate and backfill trenches, place the cable in concrete encased duct bank, and testing all circuit loops in accordance with the testing procedures in contract documents, and all incidentals activities related to them.

C. Protect the existing airport vaults and control tower from any damage to the building, equipment, and wiring while adding or improving the existing equipment in accordance with the plans and/or specifications.

D. Furnish and install new signs complete with filters for Airfield Lighting Control and Monitoring System (ALCMS), base can, isolation transformer, connectors, all hardware, cabling, and associated conduits.

E. Furnish and install special blast resistant signs (Crouse-Hinds) at locations shown on the drawings, complete with filters for ALCMS, base can, isolation transformer, connectors, all hardware, cabling and associated conduits.

F. In**[new][existing]** pavement **[furnish and]** install **[new][salvaged] [in-pavement][elevated] [runway][taxiway][centerline][edge][warning][flashing guard][clearance bar][threshold][touchdown zone][other]** lights complete with base can, isolating transformer, connectors**,[synchronization units][ALCMS filters]** all hardware, cabling, and associated conduit.

G. Remove existing **[elevated][in-pavement][runway] [taxiway] [centerline] [edge] [warning][flashing guard][clearance bar][threshold][touchdown zone][signs][other]** lights [and install new] on the existing can and connect to the existing transformer**[, logitrac sensors][other].**

H. Install new blank covers on existing base cans that are to remain in place after the removal of the light fixtures.

I. Furnish and install new pullboxes and manholes in the appropriate locations shown on the drawings.

J. Provide temporary airfield lighting and power connections as required, to be used during construction.

K. Ground all equipment, enclosures, neutrals, and conduits installed under this contract, including grounding to light bases, and all incidentals.

L. Modify existing site electrical equipment complete with all wire ways, conduits, cabling, panelboards, grounding, and other appurtenant work as show on drawings.

M. Guarantee as required by the Performance and Maintenance Bond.

N. **[Replace existing incandescent/quartz taxiway lights with new Light Emitting Diode (LED) light fixtures complete with new isolation transformers and mounting rings on existing base cans. Prior to the procurement of the replacement LED light fixtures, the contractor shall field verify the dimensions and mounting arrangements of the existing light base cans to verify that the replacement LED light fixtures will fit on the existing base cans.]**

O. Provide temporary panels in the airfield signs to accommodate temporary designations of the taxiways and replace the temporary panels with the permanent panels at the completion of the project, as shown in the drawings.

P. Reconnect, re-tag and re-identify marking of the existing circuits to match revisedairfield lighting circuitry.

Q. Investigate unknown cables and conduits.

The areas of work under this contract have manholes and pull boxes, which contain existing cables, the functions of which are unknown. The cables are power, signal, lighting circuits, controls, fiber optics and other circuits. Some of the cables are spares, some cables are abandoned, some cables are active, but they are not identified in as-built drawings and other records.

As a part of this contract, the contractor shall investigate these cables and identify if they are operational, abandoned or spare. The cables shall be traced to its origin. All abandoned cables and spare cables shall be removed by the contractor. Cables that are active shall be tagged with their use and shall be reflected in the as-built drawings, from its source to the utilization point.

During the execution of the contract work, upon detection of unknown cables, the contractor shall notify the Engineer about the cables, schedule the detection

and remedial work and furnish man-hour and material required to accomplish the task.

R. Relocate **[ ]** electrical items identified on the plans including **[ ].**

S. Remove and **[dispose of][salvage]** electrical items identified on the plans including **[ ].**

T. Other items required to complete the work shown on the plans. The omission of expressed reference to any parts necessary for or incidental to the complete installation shall not be construed as releasing the Contractor from furnishing such parts.

All items of general work required, such as excavation, cutting, patching, etc., shall be included in this Contract. Installation shall be performed by experienced and skilled persons to obtain only the best workmanship. All equipment shall be set square and true with constructions. The work shall be under constant supervision by the Contractor and by an authorized and competent foreman.

The Contractor shall at all times keep the construction areas free from accumulations of waste material and rubbish, and prior to completion of work, remove any rubbish from and about the project, and all tools, reels, equipments, and materials not a part of the project. Upon completion of the construction, the Contractor shall leave the work and premises in a clean, neat, and workmanlike condition satisfactory to the Engineer. The Contractor shall be responsible for the proper performance in all respects, in whole and in part, of the electrical equipment until acceptance of the entire work by Engineer.

The electrical construction and installation shall be complete, and the Contractor shall furnish all materials, labor and equipment necessary for the satisfactory installation and operation of electrical apparatus and for the operation of the electrical system as indicated, whether specifically mentioned or not. Material shall bear the Underwriter Laboratories' seal of approval.

68-1.3 Temporary Taxiway Lighting

Temporary Taxiway Lighting shall be installed at locations shown on the plans and in conformance with the details. The temporary Taxiway Lighting shall include all new conduit, electrical cans, cables splices, connections, lighting fixtures isolation transformers, concrete weights, required cores and connections, and other appurtenances necessary to construct the

operational Temporary Taxiway Lighting system. The Contractor shall assemble and install lighting elements as shown on the plans.

The temporary lighting shall be installed, relocated and reinstalled to accommodate construction phasing and construction activities.

Installation and testing performed under this item shall be as specified in the applicable advisory circulars. Once the permanent Taxiway lighting improvements are installed and accepted by the Engineer, the Contractor shall remove and salvage the temporary Taxiway lighting. The salvaged equipment shall be delivered to the LAWA C&M as directed by the Engineer.

68-1.4 Phasing

All existing runway and taxiway lights not included in the construction phasing must be kept in operation, except as permitted otherwise by the Engineer.

The Contractor shall be responsible for troubleshooting and investigative work necessary to install completely operational temporary circuits. These shall be incidental to the other electrical work and no separate payment will be made.

The Contractor shall be responsible for installing, maintaining, and removing all required temporary light fixtures and jumper cables. The use of night floodlights is required for night work.

Contractor shall coordinate with the Airport Operations and Maintenance at the end of each work shift to ensure that all required airfield lighting circuits are operational. Contractor shall provide all labor and material for this work.

Contractor shall provide and maintain on hand sufficient equipment required to provide temporary circuit extensions. This includes, but is not limited to the following:

A. 1000 LF of two-inch RGS conduit,

B. 2000 LF L-824 cable and

C. 100 L-823 connector kits.

These items will not be available from LAWA Maintenance.

68-1.5 Interruptions And Temporary Circuits

Interruptions of runway and taxiway lighting circuits may be necessary during construction. The Contractor may use salvaged cable to prepare a reliable jumper cable to provide temporary continuity of service to taxiway lights during construction where required. The Contractor shall not interrupt air traffic or perform any work that might endanger any airport operation until approval of the Director of Operations and the Airport's Engineer has been received.

From the permanent installation, all temporary connections and re-routing of circuits shall be replaced with new materials installed in accordance with specifications and as shown on the plans.

NOTE: The Contractor shall disconnect all circuit cables from their respective power sources in the vault before working on the cables in the field in coordination with the Airport electrician and the FAA. This work is incidental to the electrical work and no separate payment will be made.

68-1.6 Removals

The Contractor shall remove all existing cables, conduits, light fixtures, signs, sign foundations isolation transformers, base cans, duct banks, duct bank markers, pull boxes, manholes, and accessories from the areas shown on the removal plans, and as directed by the Engineer. The Contractor shall exercise due care to remove existing light fixtures and transformers, and shall protect the light bases which are to remain free from damage and in good working order.

The Contractor shall core into existing manholes, pullboxes and light cans as required to make conduit connections. Lights installed in or removed from existing PCC pavement shall require a 24" diameter core. At locations were cores will be made in existing PCC pavement and new fixtures not installed the contractor shall backfill void with PCC.

Cables, conduits, ducts, and light bases to be removed shall be disposed of legally, off Airport property, as described in Section 14 of these specifications. All debris shall be removed off Airport property.

All light fixtures airfield signs and isolation transformers, power transformers which are not to be reinstalled, shall be delivered to the Airport Maintenance Yard at 7411 World Way West. Cables, conduits, ducts, and light bases removed shall be disposed of off Airport property as described in Section 14 of these specifications. Lighting fixtures including bases shall be cleaned of all epoxy sealing material, pavement, dirt, etc. by sandblasting if necessary prior to delivery to LAWA. Transformers shall be cleared loose of dirt prior to delivery.

68-1.7 Maintenance During Construction

Contractor shall maintain all systems and equipment provided under contract from startup of system or equipment to Final Acceptance. The maintenance activity shall include the recommendation of the manufacturers for maintenance of systems and equipment.

68-1.8 Drawings

The drawings, which constitute and integral part of this Contract, are diagrammatic in nature. They indicate the extent and general layout of the lighting system, arrangement of circuits, cables through ducts, connections to existing circuit cables and other work near the construction area. Field verification of scale dimensions is required to determine actual locations, distances, and levels. No extra compensation will be allowed because of differences between work shown on the drawings and as in the field. The Contractor shall check the plans and specifications and, if any portion of the work is found to be omitted, unclear, or in error, the Contractor shall immediately notify the Engineer. The directions of the Engineer shall be followed and the work completed accordingly.

The design drawings may be utilized in the preparation of the shop drawings showing the permanent construction as actually made.

The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.

Where a disagreement exists between the plans and specifications, the item or arrangements of better quality, greater quantity, or higher cost shall be included in the base bid.

Any discrepancies between the drawing, Advisory Circulars, and field condition must be resolved with the Engineer before bidding the job. All agreements shall be verified in writing.

The responsibility for the correct and satisfactory installation and operation of all materials and equipment required herein shall rest with the Contractor. Before any equipment is ordered or commencement of installation of lighting installations and electrical systems, a complete schedule of materials and detailed shop drawings covering all items of equipment and brochures of the lighting fixtures and signs proposed for installation shall be submitted for approval by the Engineer. The schedule of materials and shop drawings shall initially include five sets of catalog cuts; diagrams, drawings, brochures, or other such descriptive data as may be required by the Engineer. No equipment shall be ordered or put into manufacture until these shop drawings or brochures have been approved by the Engineer. Samples of conduit, duct, fittings, cables, splices, tapes, fixtures, etc., shall be required for approval. After they have been approved, samples will be returned in tested condition to the Contractor. In the event any items of material or equipment contained in the schedule fail to comply with specification requirements, such items will be rejected, and shall be returned to the contractor.

68-1.9 Site Conditions

This subsection as written in the Standard Specifications will apply under the contract.

68-1.10 Codes

The Contractor shall comply with all ordinances, laws, regulations, and codes applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations, and codes.

Regular inspections shall be requested by the Contractor as required by any and all regulations. All charges for the inspection called for by the regulating agencies of installation or plans and specifications shall be arranged and shall be paid by the Contractor.

68-1.11 Maintenance and Operating Instructions

The Contractor shall provide the Airport's Engineer with complete instructions in the proper care and operation of the equipment installed under this contract. This is considered as part of the final inspection, and final acceptance will not be given until these instructions have been delivered.

68-1.12 Maintenance and Operating Manual

The Contractor shall collect and assemble ten (10) hardcover books containing the installation details, repair and operation instructions, schematics of actual equipment and operations, and directions supplied by the manufacturer with all equipment. Three copies of the draft maintenance and operating manuals shall be submitted to the Engineer for review and comments. Final acceptance of the work will be withheld until such data has been presented complete to the Engineer.

68-1.13 As-Built Drawings

The Contractor shall mark up one set of black line prints to show the as-built conditions, which differ from the original, including any existing utilities discovered during the course of the work. The Engineer will furnish a newly printed set of black line drawings for this purpose. As-builts shall be revised daily and initialed off by Contractor and Engineers' inspector weekly. There shall be sufficient detail, including station numbers, conduits/duct bank routing, actual location of electrical equipment markers, panel circuit numbers, etc., to allow for easy location and correction of drawings. This work shall be completed and accepted by the Engineer before approval of final payment.

68-1.14 Spare parts for Airfield Lighting and Signage System

The contractor shall furnish 5% spare parts to LAWA C&M at the end of the constructions. The spare parts for the light fixtures, signs and obstructions lights as specified on lighting fixture schedule shall include but not limited to the following:

A. Lamps of all sizes and types.

B. Lamp holders/sockets of all sizes and types.

C. Gaskets, seals and O-rings for all light fixtures and signs.

D. Reflectors for all light fixtures.

E. Lens replacement kits for all light fixtures.

F. LED power supply units for taxiway light fixtures.

G. Heat sink assembly with LED for taxiway light fixtures.

H. Isolation transformers of all types and sizes.

I. Breakable couplings for elevated airfield light fixtures.

The contractor shall submit a schedule of spare parts for airfield lighting to the Engineer for review and comments.

The contractor shall submit a schedule of airfield lighting to the Engineer for review and comments.

68-1.15 Installation Methods

The method used for the installation of electrical system and equipment shall conform to the National Electrical Contractors Association (NECA) published "Standard of Installation," except where specifically specified or shown otherwise, and to any state and local codes.

All electrical materials, construction methods, and installation shall be in accordance with applicable Federal Aviation Administration's Advisory Circulars, the latest editions, including amendments, of the City of Los Angeles Electrical Code, and the American National Standards Institute Standard C2.

All ferrous metal work shall be galvanized. If any galvanizing is damaged, the metal work shall be refinished by cleaning, treating with one coat of wash primer conforming to Federal (military) specification MIL-P-152388, and shall be given one shop coat of zinc-rich base paint

(zinc duct paint) conforming to Federal specification TT-P-641F Type II immediately when the wash primer is dry.

In order to prevent deterioration due to corrosion, all bolts, nuts, studs, washers, pins, terminals, springs, hangers, and similar fastenings, and fittings shall be, where practicable, of an approved corrosion-resisting material such as stainless steel, brass, or bronze, or of a material treated in a proved manner to render in adequately resistant to corrosion. Hot-dip galvanizing per ASTM Specification A153 will be considered such approved treatment for all ferrous hardware. Cap screws, setscrews, and tap bolts shall be of stainless steel, brass or bronze.

For grounding of all new devices, Contractor shall maintain electrical continuity throughout the system, by using the metallic conduits, threaded metallic couplings, bonding jumpers, and ground conductors in PVC conduits.

68-1.16 Quality Assurances

A. Workmanship. Workmanship shall be of consistent with the best commercial practices for installation of this type.

B. Materials. Materials and equipment shall be UL and/or FAA approved as specified herein. When material are used that are not specifically designate herein, they shall be in accordance with the best industry standards and practices for equipment of this type. All components and parts shall be suitable for operation under the environmental conditions specified herein. Metal parts shall be either inherently corrosion-resistant or shall be suitably protected to resist corrosion or oxidation during extended service life.

C. Parts Rating. All parts shall be of adequate rating for the application and shall not operate above the parts manufacturers recommended ratings.

D. Environmental Conditions. The equipment installed in vault and outdoors shall be designated for continuous outdoors operation under the following environmental conditions:

(1) Temperature: Any ambient temperature from minus 20^{o}F to plus 120^{o}F.

(2) Altitude: 800 Ft above MSL.

(3) Humidity: Up to 100 percent.

(4) Sand and Dust: Exposure to windblown sand and dust particles.

(5) Wind: Operation at wind velocities up to 200 miles per hour.

(6) Water: Components provided for underground installation, or installed in underground housing, shall be suitable for continuous operation submerged in water.

68-1.17 Testing

The Contractor shall furnish all materials, labor, equipment and appliances necessary to test all contractor furnished equipment and the completed cable systems. A "Burn" test will be required for the lights. It shall be the Contractor's responsibility to demonstrate to the satisfaction of the Engineer that the lighting circuits are continuous and free from short and open circuits and unspecified grounds, that the circuits are properly connected, that the circuits are operable and automatic, and the resistance to ground of each non-grounded conductor is less that 50 megohms. All cables shall be tested in accordance with the requirements of Section 55 of these Specifications.

68-1.18 Inspection

At the completion of the electrical work, the Contractor shall secure approval from the FAA, Engineer and Owner for final payment.

68-1.19 Safety Procedures for Working on airport Lighting System

The Contractor shall follow the safety procedures set by Los Angeles International Airport for working on the airfield power and lighting as specified below:

A. Procedures for Taking Circuits out of Service

(1) Contractor shall notify the Inspector which circuits are to be taken out of service and the specified portions to be worked on.

(2) Inspector shall notify Operations, who will notify the Tower, to verify that the circuits can be removed from the Tower control.

a. If the Tower relinquishes control, Operation will notify the Airport electrician.

b. If the Tower does not relinquish control, no work can be done on the circuits at this time. (With the Tower in control, the circuits can be energized at any time.).

(3) If the Tower relinquishes control, the Airport electrician and the Contractor's electrician will proceed to the vault where the regulator will be taken out of service by the Airport electrician and tagged by the contractor's electrician.

(4) The Airport electrician will log – time, circuits and Contractor – into the vault log.

(5) After shutdown, the Contractor shall field test the circuits to verify that they are not energized before starting work on the circuits in the field.

B. Procedures for Placing Circuits Back in Service

(1) The Contractor will notify the Inspector when circuits are ready to be tested.

(2) The Inspector will contact all other inspectors who are working with the Contractor's electricians and notify them that the lighting circuits are about to be energized. When it has been verified that all personnel are clear, the Inspector will call Operations requesting a "burn".

(3) Operations will notify the Airport electrician. The Airport Electrician and contractor's electrician will meet at the vault, where the contractor's electrician will remove its tag. The Airport electrician will then energize the circuits.

a. If all lights are operating, control of the lights will be given back to the tower.

b. If all the lights are not operating, the Airport electrician will work with the contractor's electrician to rectify the problem.

68-2 AIRPORT LIGHTING SYSTEM

68-2.1 General

This item consists of airport lighting systems furnished and installed in accordance with this specification, the reference specifications and the applicable advisory circulars. The systems shall be installed at the general locations and in accordance with the dimensions, design, and details shown in the plans. This item includes the furnishing of all equipment, material, services, and incidentals necessary to place the system in operation as completed units.

Additional details pertaining to a specific system covered in this item are contained in the following Advisory Circulars. Advisory Circulars carry an alpha character at the end of the number to designate editions. In this specification, and in the drawings, the intent has been to list only the number of the Advisory Circular - the latest version of that document controlling. Should an older version of the document be listed, and there exists a later edition (150/5345-47B instead of 150/5345-47A, for example), the later edition shall govern. The Contractor shall have a copy of the latest edition of these in his files:

[ADD / DELETE / UPDATE AS APPROPRIATE]

A. FAA A C 150/5340-18: Standard for Airport Sign Systems.

B. FAA AC 150/5340-30: Design and Installation Details for Airport Visual Aids.

C. FAA AC 150/5345-7: Specifications for L-824, Underground Electrical Cables for Airport Lighting Circuits.

D. FAA AC 150/5345-26: Specifications for L-823, Plug and Receptacle, Cable Connectors.

E. FAA AC 150/5345-42: Specifications for Airport Light Bases, Transformer Houses, Junction Boxes and Accessories.

F. FAA AC 150/5345-44: Specifications for Taxiway and Runway Signs.

G. FAA AC 150/5345-46: Specifications for Runway and Taxiway Light Fixtures Including FAA LED requirements, Document -2001.

H. FAA AC 150/5345-47: Isolation Transformer for Airport Lighting Systems.

I. FAA AC 150/5345-2: Standards for In-Pavement Runway Guard Lights

J. [OTHER]

Codes and Regulations applicable to the project include, but are not limited to:

A. FAA Advisory Circulars

B. National Electrical Code (NEC)

C. City of Los Angeles, Building Safety Code (Electrical)

D. Underwriters Laboratories (UL) Listing requirements for Airfield Lighting products.

68-2.2 Equipment and Materials

A. General

(1) Airport lighting equipment and materials covered by FAA specification shall have the prior approval of the Federal Aviation Administration, Airports Service, Washing, D.C. 20591, and shall be listed in Advisory Circular 150/5345-53, Approved Airport Lighting Equipment.

(2) All other equipment and material covered by other referenced Specifications shall be subject to acceptance through the manufacturer's certification of compliance with the applicable specifications.

(3) List of the equipment and materials required for a particular system are contained in the applicable advisory circulars.

B. Tape

Rubber and plastic Electrical tapes shall be Scotch Electrical Tapes – number Scotch 88 (1-1/2" wide) and Scotch 130C linerless rubber splicing tape (2" wide), as manufactured by the Minnesota Mining and Manufacturing Company, or approved equivalent.

C. Concrete

Concrete shall conform to the requirements of Section 54 of these Specifications.

D. Colored Filters

Colored filters or colored lenses to be used for runway and taxiway Lights shall conform to the requirements of Military Specification MIL-C-25050 Type I.

E. Squeeze Connectors

Squeeze connectors, shall be equal to Crouse-Hinds Company, Type CGB cable connector with neoprene rubber bushing, or approved equal.

F. Lamps

All lamps installed in existing units shall be new. Lamps shall be of size and type to provide the distributions and minimum output requirements of isocandela curves shown for each size in AC 150/5345-46.

G. Isolating Transformers

Isolating transformers installed in all units shall be new L-830 conforming to requirements of Advisory Circular 150/5345-47, Isolating Transformers for Airport Lighting Systems.

H. Airfield Light Fixture Identification

All new airfield light shall be identified with new Painted identification/circuit numbers as indicated on the plans. Painted numbers shall be 4" high applied with stencils, black in color. Background shall be white, 6" high, of length required for identification/circuit numbers.

Location of painted ID numbers for elevated fixtures shall be immediately adjacent to the fixtures. Location of painted ID numbers for runway and centerline fixtures shall be 2 feet away from the painted edge stripe. On East/west direction runways and taxiways, locate the stencil on the north side. On north/south or angled runways or taxiways, locate the stencil on the west side. At intersections where centerline fixtures occur, place the stencil adjacent to the fixture as directed by the Engineer.

I. Identification Number Plates

The identification number plates for all lights shall be non-corrosive metal disc of 2-inch minimum diameter, with numbers permanently stamped with steel dies or cut out, installed on the cable, inside of the light bases. The identification tag shall contain the ID/Circuit Number corresponding to the indications shown on the plans.

68-2.3 CONSTRUCTION METHODS

A. General

The installation and testing to be performed under this item shall be as specified in AC 150/5340-30 and other applicable advisory circulars. Light fixtures with Light Emitting Diode (LED) technology shall be certified to meet the most recent publication of the FAA Advisory Circular 150/5345-46 including any relevant addendums. All lighting products shall have warrantee for workmanship and photometric performance for a minimum of five (5) years.

B. Light Placement

The light fixtures shall be installed at the location and in conformance with the details shown on the plans. The exact location shall never be closer than 2'-6" on center to a joint. Each light fixture in all lines of light shall be positioned with use of survey instruments as it is being installed so as to ensure that all lights are in straight alignments. All lines upon completion shall be true to line and uniform as judged by the Engineer.

C. Airfield Lighting Fixtures

Airfield lighting fixtures shall conform to FAA specification for the particular type and application of the lights. The light fixtures shall be as shown in the light fixtures schedules in the drawings.

D. The installation and testing details for the system shall be as specified in the FAA Advisory Circular AC 150/5340-30.

E. Orientation of Light Beam for Taxiway Centerline Lights

Taxiway centerline lights should be oriented as follows with a horizontal tolerance of plus or minus 1 degree.

(1) On Straight Segments: On all straight portions of taxiway Centerlines, the axis of the light beam should be parallel to the Centerline of the taxiing path.

(2) On Curved Portions (Excluding High Speed Exit Taxiways with Standard Fillets): Orient the axes of the two beams of bidirectional lights parallel to the tangent of the nearest point of the curve designated as the true centerline of the taxiway path. Orient the axis of the un-directional light beam so that it is "toe-in" to intersect the centerline at a point approximately equal to four times the spacing of lights on the curved portion. Measure this spacing along the chord of the curve.

(3) High speed Exit Taxiways: Orient the axis of a unidirectional Light beam so that it is "toed-in" to intersect the centerline at a point approximately equal to four times the spacing of the lights on the curved portion. Measures this spacing along the chord of the curve. Orient the Axis of the two beams of bidirectional lights parallel to the tangent of the nearest point of the curve designated as the true centerline of the taxiing path with a tolerance of plus or minus one-half a degree.

68-2.4 Lighted Guidance Signs

A. General

Signs shall be "Lumacurve" with low voltage quart lamps, to match existing airfield signs, or approved equal. In specific locations as indicated in the drawings, Crouse-Hinds blast-proof signs with fluorescent lamps shall be used. Internally lighted guidance signs for series circuits shall be furnished and installed in accordance with this specification and with the dimensions, locations, and details as shown on the plans. This work includes furnishing and installing filters, transformers, base cans, mounting assemblies, including base plate and mounting flanges and concrete footing. Also included are all cable connections, all lamps, testing of the installations, and all incidentals necessary to place these signs in operation as completed units.

B. Sign Construction

(1) The signs shall be constructed of lightweight, nonferrous materials. Mounting hardware and fasteners may be ferrous if adequately protected from corrosion. The signs shall meet the current FAA standards for frangibility. All signs shall be designed for installation on a concrete pad, and all required mounting hardware shall be supplied with the sign. The signs shall be as light as possible.

(2) Airfield Sign Volt-Ampere (VA) shall not exceed the maximum VA specified. Lights shall work from variable constant current source (2.8A to 6.6A). All signs connected to 5

step (High Intensity System) or to 3 step (Medium Intensity System) regulators, must maintain full brightness throughout all steps. All signs shall be provided with externally mounted (on the unit) on/off power switch, which on "off" position should short the secondary of the transformer. The switch shall be "Make before break" type.

(3) The signs shall be single or double face, as indicated on the plans. Single face and double face signs shall have identical construction, except that the single face signs shall only have one side visible to pilot reading and the other side shall be blanked off. This is done so at a later date the single face signs may easily be used as double face signs.

(4) The signs shall be 1, 2, 3, or 4-modules in length as indicated in the Sign Legend Table. The 1 and 2-module signs shall be supported by 4 legs and the 3 and 4-module signs shall be supported by 8 legs, as shown on details.

(5) All signs shall be provided with the proper power cord and plug, and two restraining tethers. Each sign shall be equipped with a ground lug. The ground cable shall be able to break away when the sign falls down.

(6) Signs shall be of modular construction; 1, 2 and 3 module signs must be designed and constructed so that additional modules may be used to add additional characters without replacing the entire sign, and, characters may be removed by adding a blanking panel without replacing the entire legend. Sign faces shall be curved in shape and made of acrylic plastic; single face panels shall not exceed 42" in length to allow safe removal and replacement of panels by a single workman.

C. Wind Loading

Signs shall be designed and manufactured in accordance with The FAA-requirements for wind load and frangibility as set in FAA Advisory Circular 150/5345-44, latest edition.

D. Isolation Transformers

Isolation transformers shall conform to FAA Specification L-830, AC 150/5345-47 "Isolation Transformers for Airport Lighting Systems."

E. Transformer Bases

Transformer bases shall conform to FAA Specification L-867 and L-868, AC 150/5345-42 "Specification for Airport Light Bases, Transformer Houses, Junction Boxes and Accessories."

F. Sign Placement

Install signs at the locations shown on the plans.

G. Concrete Pads

Concrete pads shall be constructed to the dimensions as detailed on the drawings. Exposed concrete surface shall be finished smooth with a street trowel or rubbed to a smooth finish. All horizontal edges shall be chamfered ¾ inch at 45 degrees. Install a minimum of one transformer base in each concrete pad. Place anchor bolts for additional flange supports in concrete pad in correct position.

H. Nameplate

Each sign shall have a nameplate giving the sign name and number as shown on the plans, Type, Size, Style, Class, manufacturer's name, address, catalog number, and the total load and power factor of the sign, including required adapter units.

I. Leveling

During construction of pad, transformer base shall be adjusted and firmly held in place so that the machined upper surface of the base flange will be level within 2 degrees and shall not protrude above the surface of pad. All other bearing areas for additional flange supports shall be in the same horizontal plane as transformer base flange.

J. Identification Tags

Tags shall consist of a copper metal disc of 2 inches minimum diameter, with numbers permanently stamped. Attach to sign housing with two sheet metal screws.

K. Cable Entrance

Seal cable entrance to the base (or to conduit or tee leading into the base) by squeeze connectors. Use galvanized conduit reducers where required. Provide squeeze connectors with a rubber bushing of correct size to fit outside diameter of cable. Tighten connectors sufficiently to provide a watertight seal without deforming insulation and sheath of cable.

L. Cable Connection

In making cable connections to airfield signs, pull underground supply cable into each light base, leaving 5'-0" slack cable inside the base to permit all connections to be made above ground. Cable connections to be made to the transformer or fixture by the following method.

(1) Plug the transformer primary lead connectors directly into matching connectors of field-attached or factory-molded, plug-in splices on the supply cables. Attach splices to supply cables as specified in section on underground cable.

(2) Wrap joint where transformer mating connectors come together with at least two layers of plastic tape, one-half lapped, extending at least 1 ½ inches beyond each end of connector.

M. Assembling Unit

Assemble signs and connect in accordance with manufacturer's Installation instructions. Connect transformer secondary leads to fixture leads by means of a disconnecting plug and receptacle and do not tape connection. Install lamps of proper rating in the fixture.

N. Special Electrical Filters

Existing airport light system control and monitoring system (ALCMS) is Digitrac/Logitrac as manufactured by Crouse-Hinds Airfield Lighting Products. Special filters are required in the sign unit base cans for the monitoring and control system to operate trouble free. Contractor shall coordinate with Crouse-Hinds to obtain technical data and filter units that are required.

O. Testing

After installation of the signs, the current to the lamps shall be checked with a true RMS ammeter. The current shall be adjusted to the value recommended by the manufacturer. Fully test installation by continuous operation for a period of not less than ½ hour as completed until prior to acceptance. These tests shall include functioning of each control not less than ten times. Test completed circuit in accordance with applicable provisions of section specifying underground cable.

68-3 ELECTRICAL POWER WORK

68-3.1 Product Delivery, Storage and Handling

Provide factory-wrapped water-proof flexible barrier material for covering wire and cable on wood reels, where applicable; and weather resistant fiberboard containers for factory-packaging of cable, wire and connectors; remove from project site.

Store cables and connectors in factory-installed covering in a clean, dry indoor space, which provides protection against the weather.

68-3.2 Grounding.

Furnish labor and materials to provide grounding facilities for the entire electrical installation as required by all inspecting and jurisdictional authorities as herein specified. Grounding system components shall be UL approved and the installation shall conform to the NEC.

A. Inspection

Installer must examine the areas and conditions under which conduit and fittings are to be installed and notify the Contractor in writing of conditions detrimental unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Installation

Install conduit and fittings as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of the NEC and the National Electrical Contractors Association's "Standard of Installation" and in accordance with recognized industry practices to ensure that products service the intended functions.

All new conduit installed in Vaults and Electrical Equipment Rooms shall be rigid, hot-dip steel meeting requirements of ANSI C80 and UL6.

Conduit shall be run at right-angles or parallel to walls and ceilings.

Grounding shall include but not limited to the following:

(1) Electrical service neutral conductor.

(2) Neutral conductor of all transformer secondaries.

(3) Conduits, boxes and other conductor enclosures. Neutral or identified conductor of interior wiring system.

(4) Distribution panels, power and lighting panelboards.

(5) Non-current-carrying parts of fixed equipment, such as transformers, motors, starter, control cabinets, disconnects, lighting fixtures, stand-by generator, telephone cabinets, and auxiliary systems cabinets, etc..

(6) Manholes, pullboxes, and hand holes.

(7) Electrical service neutral conductor.

(8) Neutral conductor of all secondary for all transformers.

(9) Conduits, boxes and other conductor enclosures. Neutral or identified conductor of interior wiring system.

(10) Distribution panels, power and lighting panel boards.

(11) Non-current-carrying parts of fixed equipment, such as transformers, motors, starter, control cabinets, disconnects, lighting fixtures, stand-by generator, telephone cabinets, and auxiliary systems cabinets, etc..

(12) Conduit Grounding: All grounding bushings with all enclosures including equipment enclosures, shall be wired together and connected internally to the enclosure Grounding conductors sized in accordance with NEC shall be used with all grounding bushings.

(13) Equipment Grounding: All electrical equipment shall be grounded. Large Equipment such as metal-clad or metal-enclosed panel will be furnished with a grounding bus. Most other equipment will be furnished with grounding pads or grounding lugs. All ground connections shall be cleaned immediately prior to connection. Contractor shall provide all grounding material required but not furnished with the equipment. No grounding conductor shall be smaller in size than 12 AWG unless it is a part of an acceptable cable assembly.

68-3.3 Dry Type Power Transformer

Dry type power transformers shall be NEMA 3R, weatherproof type, enclosed and ventilated. Transformer shall be designed constructed and rated in accordance with UL, NEMA, ANSI, IEEE and OSHA standards. The ratings shall be as indicated in the plans. The transformers shall have a 220 degrees Celsius insulation system and be designed not to exceed 115 degrees Celsius temperature rise above a 40 degree Celsius ambient under full load conditions. In addition, the transformer shall have the ability to carry a continuous 15% overload without exceeding a 150 degree Celsius rises above ambient.

Two 2.5% above normal full capacity and two 2.5% below normal full capacity primary taps shall be provided.

Transformer enclosure finish shall be ASA 61 gray powder polyurethane paint. Transformer enclosure temperature shall not exceed 50 degrees C plus the ambient under any condition of loading at any specified temperature rise at or below 150 degrees C.

Transformer enclosure shall be UL/NEMA Type 2 and UL 3R Listed with the addition of weather shield and shall be so marked on the transformer.

Transformer must operate at and audible sound levels below NEMA standard ST-20.

Copper termination bus bars or lugs shall be provided for all terminations.

Complete shop drawings and typical performance test data shall be submitted to the Engineer for approval. Factory tests shall conform with ANSI Test Code C57.12.91.

68-3.4 Surge Arrester

Surge Arrester shall be UL listed and conforming to ANSI/IEEE C.62. The rating shall be as indicated in the plans.

68-3.5 Fused Disconnect Switches

Fused disconnect switches shall be heavy duty type with quick-make, quick-break operating mechanism, dual cover interlock and color coded indicator handle.

Heavy duty fused disconnect switches shall be UL listed and conform to NEMA standard KS1. Fused disconnect switches shall have NEMA 3R enclosures.

68-3.6 Medium Voltage Power Cables

Medium voltage power cable shall be Ethylene-Propylene-Rubber insulated (EPR) with PVC jacket. Cables shall be single conductor 5kV nominal rated, consisting of Class B stranded copper conductors, and extruded semi-conducting shield over the conductor, ethylene propylene rubber insulation, an extruded semi-conducting shield with copper tape shield wrapped helically with minimum 12.5 percent overlap and a PVC jacket.

EPR cable shall conform to NEMA WC8 and UL listed.

Manufacturer's instructions shall be provided showing recommended sequence and method of installation and termination of medium voltage power cables.

Personnel performing termination and splices shall have at least 3 years experience in cable termination. Engineer my request proof of experience of cable terminators.

Field testing of cable, termination and splices shall be performed by the Contractor in accordance with NEMA WC 5 and NETA standards.

68-4 METHOD OF MEASUREMENT

The quantity of **[signs,] [temporary panels for the designated signs,] [lights,] [temporary fixtures][L-868 cans with ¾" steel cover][other]** complete with transformer housing, isolation transformer, concrete foundation, and other bid items to be paid for under this item shall be the number of each type **[signs,] [lights,][base cans,]** or other items installed as complete units in place, ready for operation, and accepted by the Engineer. This price shall be full compensation for furnishing all material and for all preparation, assembly, and installation of these materials, and for all labor, supervision, equipment, tools, and incidentals necessary to complete this item.

"Standing Red" barricade lights will be measured for payment as lump sum items which shall include all costs for fixtures, cable, conduit, sandbags, relocating as needed, including connecting, disconnecting, and all incidentals necessary for providing and maintaining standing red barricade lighting throughout the project duration to the satisfaction of the Engineer.

Temporary circuits and fixtures will be measured for payment as lump sum items which shall include all costs for fixtures, cable, conduit, sandbags, relocating as needed, including connecting, disconnecting, and all incidentals necessary for providing and maintaining standing temporary lighting throughout the project duration to the satisfaction of the Engineer.

All vault and electrical equipment room work as shown on the plans shall be measured as a lump sum item for a completed installation as shown on the plans and approved by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, labor, supervision, equipment, tools, and incidentals necessary to complete this item.

Relocation of **[ ]** shall be measured for payment as a lump sum item, which shall include field measurement, mounting bolts, concrete pad, coordination with FAA, and all other incidental items necessary to provide a functional facility in the relocated position.

The investigation of unknown cables shall be measured as a lump sum and shall be paid and prorated out of an allowance, stipulated in the " Schedule of Work and Prices" as a part of the Bid Package. Contractor shall furnish actual material and man-hours expended in this item of work for payment up to the allowance amount.

Removals shall be measured as a single lump sum item, including demolition, removal, legal disposal off the airport, and cleanup.

68-5 BASIS OF PAYMENT

Payment will be made at the contract unit for each complete **[sign,] [temporary panel for the designated signs,] [light,] [temporary fixture][L-868 can with ¾" steel cover][other]** of the type and size indicated, installed in place by the contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools, testing, maintenance and incidentals necessary to complete this item.

Payment will be made at the contract lump sum price for "Standing Red" barricade lights. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.

Payment will be made at the contract lump sum price for temporary circuits and fixtures barricade lights. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.

Payment will be made at the contract lump sum price for temporary circuits and fixtures barricade lights. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.

Payment for electrical power work in vaults, electrical equipment rooms and site will be made at the contract lump sum price for all work, including providing and installing power transformers, disconnect switches and power cables. No separate payment will be made equipment concrete pads, grounding system, connections and testing. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor equipment, supervision, tools and incidentals necessary to complete this item.

Payment will be made at the contract lump sum price for relocation of **[ ].** This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, supervision, tools and incidentals necessary to complete and maintain these items.

The investigation of unknown cables shall be measured as a lump sum and shall be paid and prorated out of an allowance, stipulated in the " Schedule of Work and Prices" as a part of the Bid Package. Contractor shall furnish actual material and man-hours expended in this item of work for payment up to the allowance amount.

Payment for all removals shall be made at the contract lump sum price for all work necessary to complete the removals as shown on the plans. This price shall be full compensation for all demolition, removals, disposal and cleanup, and for all labor, equipment, supervision, tools and incidentals necessary to complete this item.

No separate payment shall be made for reconnecting, re-tagging and re-identifying markings of the existing circuits to match revised airfield lighting circuitry, which should be considered as incidental to airfield lighting work.

No additional payment will be made for difficulties encountered when accomplishing work required by this section of the specifications in areas of night construction, or in other areas subject to constructions phasing restrictions.

Payment will be made under:

Item 68.1 Sign **[1]2][3][4]**-module, size **[3][4]** , **[single][double]** face ..... per each

Item 68.2 Temporary Sign **[1]2][3][4]**-module, size **[3][4]** , **[single][double]** faceper each

Item 68.3 **[In- Pavement][Elevated][runway][taxiway][centerline][edge][guard] [other]** light with base can, and isolation transformer in **[new][existing] [PCC][AC]** pavement ..... per each

Item 68.4 "Standing Red" barricade lights ..... per lump sum

Item 68.5 Temporary Lighting ..... per lump sum

Item 68.6 Electrical power work at **[ ]** ..... per lump sum

Item 68.7 Relocate [ ] ..... per lump sum

Item 68.8 Investigation of unknown cables .....per allowance

Item 68.9 Removal of electrical items ..... per lump sum

Item 68.10 **[Other]** ..... per **[each][lump sum][allowance]**

END OF SECTION 68

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Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. Install/remove, and modify taxiway and runway lighting, illuminated signage, power supply, cabling and electrical conduit and all other electrical work
2. In accordance with AC 150/5370-10.
3. Contractor shall have 5 years of verifiable experience
4. The Contractor shall pay for all electrical inspections and permits
5. Contractor shall furnish the Engineer a list of the equipment and materials.
6. Work shall be performed in accordance with these specifications:
   a) Section 69
   b) Section 70
   c) Section 71
   d) Section 72
7. The following electrical equipment shall conform to the following FAA specifications.
   a) L-804
   b) L-804E
   c) L-850A
   d) L-850B
   e) L-850C
   f) L-852C
   g) L-852D
   h) L-852E
   i) L-852G
   j) L-852T
   k) L-858Y, R, L, B
   l) L-861T
   m) L-862

II. SUMMARY OF WORK

A. The work to be performed shall include complete electrical work

B. This work includes but is not limited to the following:

1. Maintain in operation all existing field electrical facilities
2. Furnish, install, test and tag underground cable (L-824)
3. Furnish and install new signs complete
4. Furnish and install special blast resistant signs
5. In**[new] [existing]** pavement **[furnish and]** install **[new] [salvaged] [in-pavement] [elevated] [runway] [taxiway] [centerline] [edge] [warning] [flashing guard] [clearance bar] [threshold] [touchdown zone] [other]** lights
6. Remove existing **[elevated] [in-pavement] [runway] [taxiway] [centerline] [edge] [warning] [flashing guard] [clearance bar] [threshold] [touchdown zone] [signs] [other]** lights
7. Install new blank covers on existing base cans
8. Furnish and install new pullboxes and manholes
9. Provide temporary airfield lighting and power connections
10. Ground all equipment
11. Modify existing site electrical equipment
12. Guarantee as required by the Performance and Maintenance Bond.
13. [Replace existing incandescent/quartz taxiway lights with new Light Emitting Diode (LED)]

14. Provide temporary panels in the airfield signs to accommodate temporary designations
15. Reconnect, re-tag and re-identify marking of the existing circuits
16. Investigate unknown cables and conduits.
    a) The areas of work contain existing cables, the functions of which are unknown.
    b) As a part of this contract, the contractor shall investigate these cables
    c) upon detection of unknown cables, the contractor shall notify the Engineer
17. Relocate **[ ]** electrical items identified on the plans including **[ ].**
18. Remove and **[dispose of][salvage]** electrical items identified on the plans including **[ ].**
19. Other items required to complete the work shown on the plans.
    a) All items of general work required, such as excavation, cutting, patching, etc.,
    b) The Contractor shall at all times keep the construction areas free
    c) The electrical construction and installation shall be complete.

III. TEMPORARY TAXIWAY LIGHTING

A. Temporary taxiway lighting shall be installed at locations shown on the plans
B. The temporary lighting shall be installed, relocated and reinstalled
C. Installation and testing performed under this item shall be as specified

IV. PHASING

A. All existing runway and taxiway lights not included must be kept in operation
B. The contractor shall be responsible for troubleshooting and investigative work
C. The contractor shall be responsible all required temporary light fixtures
D. Contractor shall coordinate with the airport operations and
E. Contractor shall provide sufficient equipment required to provide temporary circuit
    1. XXX LF of two-inch RGS conduit
    2. XXX LF L-824 cable
    3. XXX L-823 connector kits.

V. INTERRUPTIONS AND TEMPORARY CIRCUITS

A. The contractor shall not interrupt air traffic
B. All temporary connections and re-routing of circuits shall be replaced with new materials
C. **Note**: the contractor shall disconnect all circuit cables from their respective power sources

VI. REMOVALS

A. The contractor shall remove all existing accessories from the areas shown
B. The contractor shall core as required to make conduit connections.
C. Cables, conduits, ducts, and light bases to be removed shall be disposed of legally
D. All light fixtures shall be delivered to the airport maintenance yard at 7411 world way west.

VII. MAINTENANCE DURING CONSTRUCTION

A. Contractor shall maintain all systems and equipment provided under contract

VIII. DRAWINGS

A. The drawings are diagrammatic in nature.
B. The design drawings may be utilized in the preparation of the shop drawings
C. The plans and specifications are complementary
D. Where a disagreement exists the item or arrangements of better quality, greater quantity, or higher cost shall be included in the base bid.
E. Any discrepancies must be resolved with the engineer before bidding the job.
F. The responsibility for the correct and satisfactory installation required herein shall rest with the contractor.

IX. SITE CONDITIONS

A. This subsection as written in the standard specifications will apply under the contract.

X. CODES

A. The contractor shall comply with all ordinances, laws, regulations, and codes applicable to the work involved.
B. Regular inspections shall be requested by the contractor as required by any and all regulations.

XI. MAINTENANCE AND OPERATING INSTRUCTIONS

A. The contractor shall provide the airport's engineer with complete instructions.

XII. MAINTENANCE AND OPERATING MANUAL

A. The contractor shall collect and assemble ten (10) hardcover books containing the installation details

XIII. AS-BUILT DRAWINGS

A. The contractor shall mark up one set of black line prints to show the as-built conditions

XIV. SPARE PARTS FOR AIRFIELD LIGHTING AND SIGNAGE SYSTEM

A. The contractor shall furnish 5% spare parts to lawa c&m
   1. Lamps
   2. Lamp holders/sockets
   3. Gaskets, seals and O-rings
   4. Reflectors
   5. Lens replacement kits
   6. LED power supply units
   7. Heat sink assembly with LED
   8. Isolation transformers
   9. Breakable couplings
B. The contractor shall submit a schedule of spare parts
C. The contractor shall submit a schedule of airfield lighting

XV. INSTALLATION METHODS

A. The method used for the installation shall conform to the (neca)
B. All electrical materials, methods, and installation shall be in accordance with applicable federal aviation administration's advisory circulars
C. All ferrous metal work shall be galvanized.
D. All fittings shall be, of an approved corrosion-resisting material
E. Contractor shall maintain electrical continuity throughout the system.

XVI. QUALITY ASSURANCES

A. WORKMANSHIP
   1. Workmanship shall be consistent
B. MATERIALS
   1. Materials and equipment shall be ul and/or faa approved
C. PARTS RATING
   1. All parts shall be of adequate rating
D. ENVIRONMENTAL CONDITIONS
   1. The equipment installed shall be designated for continuous outdoors operation
      a) Temperature:
      b) Altitude:
      c) Humidity:
      d) Sand and Dust:
      e) Wind:
      f) Water:

XVII. TESTING

A. The contractor shall furnish all materials, labor and appliances necessary to test

XVIII. INSPECTION

A. At the completion of work, the contractor shall secure approval

XIX. SAFETY PROCEDURES FOR WORKING ON AIRPORT LIGHTING SYSTEM

A. The contractor shall follow the safety procedures
   1. Procedures for Taking Circuits out of Service
      a) Contractor shall notify the Inspector
      b) Inspector shall notify Operations, who will notify the Tower
      c) After shutdown, the Contractor shall field test the circuits
   2. Procedures for Placing Circuits Back in Service
      a) The Contractor will notify the Inspector
      b) The Inspector will contact all other inspectors
      c) Operations will notify the Airport electrician

XX. AIRPORT LIGHTING SYSTEM

A. GENERAL
   1. This item consists of airport lighting systems furnished and installed
   2. Additional details are contained in the following Advisory Circulars.
      a) FAA A C 150/5340-18
      b) FAA AC 150/5340-30
      c) FAA AC 150/5345-7
      d) FAA AC 150/5345-26
      e) FAA AC 150/5345-42
      f) FAA AC 150/5345-44
      g) FAA AC 150/5345-46
      h) FAA AC 150/5345-47
      i) FAA AC 150/5345-2
   3. Codes and Regulations applicable to the project include
      a) FAA Advisory Circulars
      b) National Electrical Code (NEC)
      c) City of Los Angeles, Building Safety Code (Electrical)
      d) Underwriters Laboratories (UL)

B. EQUIPMENT AND MATERIALS
   1. General
      a) Airport lighting equipment shall have the prior approval of the FAA
      b) All other equipment and material shall be subject to acceptance
      c) List of the equipment and materials required for a particular system are contained in the applicable advisory circulars.
   2. Tape
      a) Rubber and plastic
   3. Concrete
      a) shall conform to the requirements of Section 54
   4. Colored Filters
      a) colored lenses shall conform to the requirements of MIL-C-25050 Type I.
   5. Squeeze Connectors
      a) shall be equal to Crouse-Hinds Company
   6. Lamps
      a) installed in existing units shall be new.
   7. Isolating Transformers
      a) installed in all units shall be new L-830
   8. Airfield Lighting Fixture Identification
      a) All new airfield light shall be identified with new Painted identification
   9. Identification Number Plates
      a) for all lights shall be non-corrosive metal disc

C. CONSTRUCTION METHODS
   1. General

a) installation and testing shall be as specified in AC 150/5340-

2. Light Placement
   a) fixtures shall be installed at the location shown on the plans.
3. Airfield Lighting Fixtures
   a) shall conform to FAA specification for the type of the lights.
4. The installation and testing shall be as specified in the FAA AC 150/5340-30.
5. Orientation of Light Beam for Taxiway Centerline Lights
   a) Taxiway centerline lights should be oriented
      (1) On Straight Segments
      (2) On Curved Portions
      (3) High speed Exit Taxiways

D. LIGHTED GUIDANCE SIGNS
1. General
   a) Signs shall be “Lumacurve” with low voltage LED
2. Sign Construction
   a) shall be constructed of lightweight materials.
   b) (VA) shall not exceed the maximum specified.
   c) shall be single or double face
   d) shall be 1, 2, 3, or 4-modules in length
   e) shall be provided with the proper power cord and plug
   f) shall be of modular construction;
3. Wind Loading
   a) shall be in accordance with The FAA-requirements.
4. Isolation Transformers
   a) shall conform to FAA Specification L-830, AC 150/5345-47
5. Sign Placement
   a) at the locations shown on the plans.
6. Concrete Pads
   a) shall be constructed to the dimensions on the drawings.
7. Nameplate
   a) shall have a nameplate giving the sign name and number
8. Leveling
   a) the machined upper surface of the base flange will be level within 2 degrees
9. Identification Tags
   a) Tags shall consist of a copper metal disc of 2 inches diameter
10. Cable Entrance
    a) Seal cable entrance to the base.
11. Cable Connection
    a) pull underground supply cable into each light base.
12. Assembling Unit
    a) signs and connect in accordance with manufacturer’s instructions.
13. Special Electrical Filters
    a) Special filters are required in the sign unit base
14. Testing
    a) the current to the lamps shall be checked with a true RMS ammeter.

XXI. ELECTRICAL POWER WORK

A. PRODUCT DELIVERY, STORAGE AND HANDLING
1. Provide factory-wrapped water-proof flexible barrier

B. GROUNDING
1. provide grounding facilities for the entire electrical installation
2. Inspection
   a) examine the areas which conduit and fittings are to be installed

3. Installation
   a) Install conduit and fittings as indicated

C. DRY TYPE POWER TRANSFORMER
1. Dry type power transformers shall be NEMA 3R

D. SURGE ARRESTER
1. Surge Arrester shall be UL listed

E. FUSED DISCONNECT SWITCHES
1. Fused disconnect switches shall be heavy duty type
2. Heavy duty fused disconnect switches shall be UL listed.

F. MEDIUM VOLTAGE POWER CABLES
1. Medium voltage power cable shall be insulated (EPR) with PVC jacket.

XXII. METHOD OF MEASUREMENT

A. The quantity of **[signs,] [temporary panels for the designated signs,] [lights,] [temporary fixtures][l-868 cans with ¾" steel cover][other]**
B. "Standing red" barricade lights
C. Temporary circuits and fixtures
D. The investigation of unknown cables

XXIII. BASIS OF PAYMENT

A. Payment will be made at the contract unit for each complete **[sign,] [temporary panel for the designated signs,] [light,] [temporary fixture][l-868 can with ¾" steel cover][other]**
B. Payment will be made at the contract lump sum price for "standing red" barricade lights.
C. Payment will be made at the contract lump sum price for temporary circuits and fixtures barricade lights.
D. Payment will be made at the contract lump sum price for temporary circuits and fixtures barricade lights.
E. The investigation of unknown cables shall be measured as a lump sum and shall be paid and prorated out of an allowance, stipulated in the " schedule of work and prices" as a part of the bid package.
F. Payment for all removals shall be made at the contract lump sum price for all work necessary to complete the removals as shown on the plans.
G. No separate payment shall be made for reconnecting, re-tagging and re-identifying markings of the existing circuits to match revised airfield lighting circuitry, which should be considered as incidental to airfield lighting work.
H. No additional payment will be made for difficulties encountered when accomplishing work required by this section of the specifications in areas of night construction, or in other areas subject to constructions phasing restrictions.
I. Payment will be made under:

1. 68.1 Sign **[1]2][3][4]-**module, size **[3][4] , [single][double]** face - per each
2. 68.2 Temporary Sign **[1]2][3][4]-**module, size **[3][4] , [single][double]** face - per each
3. 68.3 **[In- Pavement] [Elevated] [runway] [taxiway] [centerline] [edge] [guard] [other]** light with base can, and isolation transformer in **[new][existing][PCC][AC]** pavement - per each
4. 68.4 "standing red" barricade lights – per lump sum
5. 68.5 temporary lighting - per lump sum
6. 68.6 electrical power work at **[ ]** - per lump sum
7. 68.7 relocate **[ ]** - per lump sum
8. 68.8 investigation of unknown cables - per allowance
9. 68.9 removal of electrical items- per lump sum

10. 68.10 [other] - per **[each][lump sum][allowance]**

XXIV. END OF SECTION

SECTION 69 – UNDERGROUND POWER CABLE FOR AIRPORTS **(FAA** L-108)

69-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of underground cable for airfield electrical service in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item L-108, as included and modified hereafter, and as shown on the Plans.

ITEM L-108 UNDERGROUND POWER CABLE FOR AIRPORTS

DESCRIPTION

108-1.1 This item shall consist of furnishing and installing power cables within conduit or duct banks in accordance with these specifications at the locations shown on the plans. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the Engineer. This item shall not include the installation of duct banks or conduit, trenching and backfilling for duct banks or conduit, or furnishing or installation of any cable for FAA facilities. Requirements and payment for trenching and backfilling for the installation of underground conduit and duct banks is covered under Section 71 (FAA Item L-110 "Airport Underground Electrical Duct Banks and Conduits.")

Because of the specialized nature of the work, the Electrical Contractor and Job Superintendent shall have verifiable five years minimum of airfield electrical construction experience

EQUIPMENT AND MATERIALS

108-2.1 GENERAL.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be approved under the Airport Lighting Equipment Certification Program described in Advisory Circular (AC) 150/5345-53, current version, as well as approved by a City of Los Angeles Recognized Electrical Field Testing Agency.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify

pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. The Contractor shall be responsible to maintain an insulation resistance of 50 megohms minima, (1000V megger) with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period.

108-2.2 CABLE. Underground cable for airfield lighting facilities (runway and taxiway lights and signs) shall conform to the requirements of AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits. Conductor sizes noted above shall not apply to leads furnished by manufacturers on airfield lighting transformers and fixtures.

~~Wire for electrical circuits up to 600 volts shall comply with Specification L-824 and/or Federal Specification J-C-30 and shall be type THWN-2.~~

Underground cable for airfield lighting circuits shall be single conductor No. 8 AWG or No. 6 AWG cable with 5,000 volt, cross-linked polyethylene insulation suitable for wet and dry locations.

Other cable type, size, number of conductors, strand and service voltage shall be as specified on the plans.

108-2.3 BARE COPPER WIRE (COUNTERPOISE OR GROUND) AND GROUND RODS. Wire for counterpoise or ground installations for airfield lighting systems shall be Ground wire, #6 AWG, type THWN, stranded conforming to ASTM B3 and B8, and shall be bare copper wire conforming to the requirements of ASTM D 33.

The Contractor shall install a continuous electrical grounding system throughout the new series lighting systems. Green No. 6 AWG THWN conductors shall be used to bond all light bases, junction cans, metal conduits and enclosures, and ground rods in the concrete pull boxes together into one continuously grounded system. Each junction can, light base, and prefabricated pull box shall be supplied with a grounding lug for ground wire connections.

Ground rods shall be constructed of copper and shall be a minimum of 10 feet in length and have a 5/8" diameter.

108-2.4 CABLE CONNECTIONS. In-line connections of underground primary cables shall be of the type called for in the plans or in the proposal, and shall be one of the types listed below. When the plans or

the proposal permit a choice of connection, the Contractor shall indicate in the bid the type of connection he/she proposes to furnish.

No separate payment will be made for cable connections.

~~**a. The Cast Splice.** A cast splice, employing a plastic mold and using epoxy resin equivalent to that manufactured by Minnesota Mining and Manufacturing Company, "Scotchcast" Kit No. 82-B, or as manufactured by Hysol Corporation, "Hyseal Epoxy Splice" Kit No. E1135, or equivalent, is used for potting the splice is acceptable.~~

a. The Field-attached Plug-in Splice. Figure 3 of AC 150/5345-26, Specification for L-823 Plug and Receptacle, Cable Connectors, employing connector kits, is acceptable—for field attachment to single conductor cable. It shall be the Contractor's responsibility to determine the outside diameter of the cable to be spliced and to furnish appropriately sized connector kits and/or adapters and heat shrink tubing with integral sealant.

b. The Factory-Molded Plug-in Splice. Specification for L-823 Connectors, Factory-Molded to Individual Conductors, is acceptable.

~~**d. The Taped or Heat Shrinked Splice.** Taped splices employing field-applied rubber, or synthetic rubber tape covered with plastic tape is acceptable. The rubber tape should meet the requirements of ASTM D 4388 and the plastic tape should comply with Mil Spec. MIL-I-24391or Fed. Spec. A-A-55809. Heat shrinkable tubing shall be heavy wall, self sealing tubing rated for the voltage of the wire being spliced and suitable for direct buried installations. The tubing shall be factory coated with a thermoplastic adhesive sealant that will adhere to the insulation of the wire being spliced forming a moisture- and dirt-proof seal. Additionally, heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.~~

c. In all the above cases, connections of cable conductors shall be made using crimp connectors utilizing a crimping tool designed to make a complete crimp before the tool can be removed. All L-823/L-824 splices and terminations shall be made in accordance with the manufacturer's recommendations and listings.

d. All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process, except the base can ground clamp connector shall be used for attachment to the base can. All exothermic connections shall be made in accordance with the manufacturer's recommendations and listings.

108-2.5 SPLICER QUALIFICATIONS. Every airfield lighting cable splicer shall be qualified in making cable splices and terminations on cables rated above 5,000 volts AC. The Contractor shall submit to the Engineer proof of the qualifications of each proposed cable splicer for the cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of ~~three (3)~~ five (5) years continuous experience in terminating/splicing medium voltage cable.

~~**108-2.6 CONCRETE.** Concrete for cable markers shall conform to Specification Item P-610, ``Structural Portland Cement Concrete.''~~

~~**108-2.7 FLOWABLE BACKFILL.** Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153 "Controlled Low Strength Material".~~

108-2.8 CABLE IDENTIFICATION TAGS. ~~Cable identification tags shall by made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.~~ Cable identification tags shall be copper, circular in shape with a minimum of two (2) inches in diameter and not less than 0.020 inches thick. Each tag shall be clearly stamped with 1/4 – inch high letters, by stainless steel lettering dies to indicate the circuit number on it. Each existing airfield lighting cable altered shall be tagged with its identification/circuit number as indicated on the plans in each manhole, pull box, transformer housing, junction can and light base. The tags shall be securely attached to the cable with No. 14 AWG TW wire.

108-2.9 TAPE. Electrical tapes shall be Scotch Electrical Tapes – number Scotch 88 (1-1/2" wide) and Scotch 130C linerless rubber splicing tape (2" wide), as manufactured by the Minnesota Mining and Manufacturing Company, or approved equivalent.

108-2.10 ELECTRICAL COATING. Scotchkote shall be as manufactured by Minnesota Mining and Manufacturing Company, or approved equivalent.

108-2.11 EXISTING CIRCUITS. Whenever the scope of work requires, connection to an existing circuit, the circuit's insulation resistance shall be tested, and the results delivered to the engineer. The test shall be performed in accordance with this item and prior to any activity affecting the respective circuit. The Contractor shall record the results on forms acceptable to the engineer. When the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, and the results delivered to the engineer. The Contractor shall record the results on forms acceptable to the engineer. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance (O&M) Manual.

CONSTRUCTION METHODS

108-3.1 GENERAL. The Contractor shall install the specified cable at the ~~approximate~~ locations indicated on the plans. ~~Unless otherwise shown on the plans~~ All cable required to cross under pavements expected to carry aircraft loads shall be installed in concrete encased duct banks. Wherever possible, cable shall be run without splices, from connection to connection.

Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor shall be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections..

In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points shall be installed at locations shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed or at least once in each access point where L-823 connectors are not installed.

Provide not less than ~~3~~ five (5) feet of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where

provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at least two feet vertically above the top of the access structure. This requirement also applies where primary cable passes through empty base cans, junction and access structures to allow for future connections, or as designated by the Engineer.

Each new field lighting cable shall be permanently tagged in each pull box, transformer housing, junction can or light base. Each existing field lighting cable affected by the current project construction shall be tagged in each pull box, transformer housing, junction can or light base. Tagging of cables will be considered incidental to other electrical work and will not be measured for payment.

The underground cable work to be performed under this contract shall consist of furnishing and installing new cables, or removing and reinstalling certain existing cables and making all necessary connections to modify and/or re-route the existing circuits, all as shown on the plans and/or as directed by the Engineer. All temporary jumper wires shall be properly protected and secured in place.

All primary cable and secondary wiring connections to isolating transformers and light assemblies shall be made by means of factory-attached plug-in connector kits in accordance with FAA Specification L-823 of Advisory Circular 150/5345-26, latest edition. Connectors shall be compatible with the insulation used. The various types of connector kits to be used shall be as indicated in the specifications.

108-3.2 INSTALLATION IN NEW DUCT BANKS OR CONDUITS. This item includes the installation of the cable in duct banks or conduit as described below. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be in accordance with the latest ~~National~~ California Electric Code, ~~or the code of the local agency or authority having jurisdiction.~~ and the local Los Angeles City Electrical Code.

The Contractor shall make no connections or splices ~~,~~ of any kind in cables installed in conduits or duct banks.

Unless otherwise designated in the plans, where ducts are in tiers, use the lowest ducts to receive the cable first, with spare ducts left in the upper levels. Check duct routes prior to construction to obtain assurance that the shortest routes are selected and interferences are avoided.

Duct banks or conduits shall be installed as a separate item in accordance with Section 71 (FAA Item L-110), ``Airport Underground Electrical Duct Banks and Conduit.'' The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to insure that the duct bank or conduit is open, continuous and clear of debris. Mandrel size shall be compatible with conduit size. The Contractor shall swab out all conduits/ducts and clean base can, manhole, etc. interiors IMMEDIATELY prior to pulling cable. Once cleaned and swabbed the base cans and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc. is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the Engineer of any blockage in the existing ducts. The cable shall be installed in a manner to prevent harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape providing moisture-tight mechanical protection with minimum bulk, or alternately, heat shrinkable tubing before pulling into the conduit and it shall be left sealed until

connections are made. Where more than one cable is to be installed in a conduit, all cable shall be pulled in the conduit-at the same time. The pulling of a cable through duct banks or conduits may be accomplished by handwinch or power winch with the use of cable grips or pulling eyes. Maximum pulling-tensions shall-be governed by cable manufacturer's recommendations. A non-hardening lubricant recommended for the type of cable being installed shall be used where pulling lubricant is required.

The manufacturer's minimum bend radius ~~or the NEC requirements whichever is more restrictive~~ shall apply. Cable installation, handling and storage shall be per manufacturer's recommendations. ~~During cold weather, particular attention shall be paid to the manufacturer's minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the Engineer, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.~~

Cable shall not be dragged across base can or manhole edges, pavement or earth. When cable must be coiled, lay cable out on a canvas tarp or utilize other appropriate means to prevent abrasion to the cable jacket.

108-3.2.1 INSTALLATION OF NEW CABLES IN EXISTING OCCUPIED CONDUIT. Existing cable(s) occupying existing conduit in which new cable is to be added shall be disconnected and pulled back to the new cable pulling point. The existing cable(s) shall be pulled back in the existing conduit along with the new cable(s). If the Engineer does not approve the use of existing cables or plug-in connectors, the Contractor shall use new material to match existing. All the existing circuits involved with reconnection must be tested as described in this section

The contractor shall furnish all necessary equipment, materials and labor for testing the underground cable circuits after installation. For new cables connected to existing airfield circuit, megger existing cable circuit prior to installation of new cables. Furnish report and notify airport engineer for any unsatisfactory insulation resistance test results. Megger and perform the dc HI-POT test to new cables installed prior to connection. After connection of new 5kv cables to existing cables are completed, megger the length of the new and existing cables, including the splice.

~~**108-3.3 INSTALLATION OF DIRECT-BURIED CABLE IN TRENCHES.** Unless otherwise specified, the Contractor shall not use a cable plow for installing the cable. Cable(s) shall be unreeled uniformly in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable(s) shall not be unreeled and pulled into the trench from one end. Slack cable sufficient to provide strain relief shall be placed in the trench in a series of S curves. Sharp bends or kinks in the cable shall not be permitted.~~

~~Where cables must cross over each other, a minimum of 3-inch vertical displacement shall be provided with the topmost cable depth at or below the minimum required depth below finished grade.~~

~~Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, handholes, pullboxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not~~

~~less than ¼ inch in size. The cable circuit identification shall match the circuits noted on the construction plans.~~

~~**a. Trenching.** Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored. Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of surface is disturbed. Graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 18 inches below finished grade, except as follows:~~

~~(1) When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches unless otherwise specified.~~

~~(2) Minimum cable depth when crossing under a railroad track, shall be 42 inches unless otherwise specified.~~

~~Dewatering necessary for cable installation, erosion and turbidity control, in accordance with Federal, State, and Local requirements is incidental to its respective pay items as part of Item L-108. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-108 Item.~~

~~The Contractor shall excavate all cable trenches to a width not less than 6 inches. Unless otherwise specified on the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.~~

~~When rock is encountered, the rock shall be removed to a depth of at least 3 inches below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4 inch sieve. Flowable backfill material may alternatively be used. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All such rock removal shall be performed and paid for under Item P-152.~~

~~Duct bank or conduit markers temporarily removed for trench excavations shall be replaced as required.~~

~~It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cable(s) cross proposed installations, the Contractor shall insure that these cable(s) are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:~~

~~(1) Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred.~~

~~(2) Trenching, etc., in cable areas shall then proceed, with approval of the Engineer, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.~~

~~In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair or replacement.~~

b. Backfilling. After the cable has been installed, the trench shall be backfilled. The first layer of backfill in the trench shall be 3 inches deep, loose measurement, and shall be either earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve. This layer shall not be compacted. The second layer shall be 5 inches deep, loose measurement, and shall contain no particles that would be retained on a 1-inch sieve. The remaining 3rd and subsequent layers of backfill shall not exceed 8 inches of loose measurement and be excavated or imported material and shall not contain stone or aggregate larger than 4 inches maximum diameter.

The second and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent undisturbed soil, and to the satisfaction of the Engineer. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

Trenches shall not contain pools of water during backfilling operations. The trench shall be completely backfilled and tamped level with the adjacent surface, except that when turf is to be established over the trench, the backfilling shall be stopped at an appropriate depth consistent with the type of turfing operation to be accommodated. A proper allowance for settlement shall also be provided. Any excess excavated material shall be removed and disposed of in accordance with the plans and specifications.

Underground electrical warning (caution) tape shall be installed in the trench above all direct-buried cable. Contractor shall submit a sample of the proposed warning tape for acceptance by the Engineer. If not shown on the plans, the warning tape shall be located six inches above the direct-buried cable or the counterpoise wire if present. A 4-6 inch wide polyethylene film detectable tape, with a metalized foil core, shall be installed above all direct buried cable or counterpoise. The tape shall be of the color and have a continuous legend as indicated on the plans. The tape shall be installed 8 inches minimum below finished grade.

c. Restoration. Where soil and sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by work shall be restored to its original condition. The restoration shall include the [sodding] [topsoiling] [fertilizing] [liming] [seeding] [sprigging] [mulching] as shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. When trenching is through paved areas, restoration shall be equal to existing conditions and compaction shall meet the requirements of Item P-152. Restoration shall be considered incidental to the pay item of which it is a component part.

*** ***

Engineer to specify the correct method of turfing and remember to include in the construction documents the appropriate FAA turfing specification for restoration related to the installation of the power cables.

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Under certain conditions, it may be beneficial to install cables by cable plowing. This type of installation method should only be specified where sandy soils are prevalent and with no rocks or other debris that would nick or cut the cable insulation. The engineer should specify the equipment to be used so the cables are placed at a minimum depth of 18 inches below finished

~~grade. The cable should be manually unreeled off the spool as the machine travels, such that the earth is not unreeling the spool.~~
~~* *~~

~~**108-3.4 CABLE MARKERS FOR DIRECT-BURIED CABLE.** The location of direct buried circuits shall be marked by a concrete slab marker, 2 feet (60 cm) square and 4-6 inches (100-150 mm) thick, extending approximately 1 inch (25 mm) above the surface. Each cable run from a line of lights and signs to the equipment vault shall be marked at approximately every 200 feet (60 m) along the cable run, with an additional marker at each change of direction of cable run. All other direct-buried cable shall be marked in the same manner. Cable markers shall be installed directly above the cable. The Contractor shall impress the word "CABLE" and directional arrows on each cable marking slab. The letters shall be approximately 4 inches (100 mm) high and 3 inches (75 mm) wide, with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep.~~

~~The location of each underground cable connection, except at lighting units, or isolation transformers, or power adapters shall be marked by a concrete marker slab placed above the connection. The Contractor shall impress the word "SPLICE" on each slab. The Contractor also shall impress additional circuit identification symbols on each slab as directed by the Engineer. All cable markers and splice markers shall be painted international orange. Paint shall be specifically manufactured for uncured exterior concrete. Furnishing and installation of cable markers is incidental to the respective cable pay item.~~

108-3.5 SPLICING. Connections of the type shown on the plans shall be made by experienced personnel regularly engaged in this type of work for not less than five (5) years and shall be made as follows:

~~**a. Cast Splices.** These shall be made by using crimp connectors for jointing conductors. Molds shall be assembled, and the compound shall be mixed and poured in accordance with manufacturer's instructions and to the satisfaction of the Engineer.~~

a. Field-attached Plug-in Splices. These shall be assembled in accordance with manufacturer's instructions. These splices shall be made by plugging directly into mating connectors. In all cases the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint.

b. Factory-Molded Plug-in Splices. These shall be made by plugging directly into mating connectors. In all cases, the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint.

~~**d. Taped or Heat-Shrinked Splices.** A taped splice shall be made in the following manner:~~

~~Bring the cables to their final position and cut so that the conductors will butt. Remove insulation and jacket allowing for bare conductor of proper length to fit compression sleeve connector with 1/4 inch (6 mm) of bare conductor on each side of the connector. Prior to splicing, the two ends of the cable insulation shall be penciled using a tool designed specifically for this purpose and for cable size and type. Do not use emery paper on splicing operation since it contains metallic particles. The copper conductors shall be thoroughly cleaned. Join the conductors by inserting them equidistant into the compression connection sleeve. Crimp~~

~~conductors firmly in place with crimping tool that requires a complete crimp before tool can be removed. Test the crimped connection by pulling on the cable. Scrape the insulation to assure that the entire surface over which the tape will be applied (plus 3 inches (75 mm) on each end) is clean. After scraping wipe the entire area with a clean lint-free cloth. Do not use solvents.~~

~~Apply high-voltage rubber tape one-half lapped over bare conductor. This tape should be tensioned as recommended by the manufacturer. Voids in the connector area may be eliminated by highly elongating the tape, stretching it just short of its breaking point. Throughout the rest of the splice less tension should be used. Always attempt to exactly half-lap to produce a uniform buildup. Continue buildup to 1-1/2 times cable diameter over the body of the splice with ends tapered a distance of approximately 1 inch (25 mm) over the original jacket. Cover rubber tape with two layers of vinyl pressure-sensitive tape one-half lapped. Do not use glyptol or lacquer over vinyl tape as they react as solvents to the tape. No further cable covering or splice boxes are required.~~

~~Heat shrinkable tubing shall be installed following manufacturer's instructions. Direct flame heating shall not be permitted unless recommended by the manufacturer. Cable surfaces within the limits of the heat-shrink application shall be clean and free of contaminates prior to application.~~

108-3.6 BARE COUNTERPOISE WIRE INSTALLATION FOR LIGHTNING PROTECTION AND GROUNDING.

Install a continuous electrical grounding system throughout the new series lighting systems. Green #6 AWG THWN conductors shall be used to bond all light bases, junction cans, metal conduits and enclosures, and ground rods in the concrete pull boxes and manholes together into one continuously grounded system. Each junction can, light base, and prefabricated pull box or manhole shall be supplied with a grounding lug for ground wire connections.

If shown on the plans or included in the job specifications, bare counterpoise copper wire shall be installed for lightning protection of the underground cables. Counterpoise wire shall be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield cables. Where the cable or duct/conduit trench runs parallel to the edge of pavement, the counterpoise shall be installed in a separate trench located half the distance between the pavement edge and the cable or duct/conduit trench. In trenches not parallel to pavement edges, counterpoise wire shall be installed continuously a minimum of 4 inches above the cable, conduit or duct bank, or as shown on the plans if greater. Additionally, counterpoise wire shall be installed at least 8 inches below the top of subgrade in paved areas or 10 inches below finished grade in un-paved areas. This dimension may be less than 4 inches where conduit is to be embedded in existing pavement. Counterpoise wire shall not be installed in conduit.

The counterpoise wire shall be routed around to each light fixture base, mounting stake, or junction/access structures. The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500feet apart around the entire circuit.

The counterpoise system shall be continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode grounding system. The connections shall be made as shown on the plans and in the specifications.

If shown on the plans or in the specifications, a separate equipment (safety) ground system shall be provided in addition to the counterpoise wire using one of the following methods:

(1) A ground rod installed at and securely attached to each light fixture base, mounting stake if painted, and to all metal surfaces at junction/access structures.

(2) Install an insulated equipment ground conductor internal to the conduit system and securely attached it to each light fixture base and to all metal surfaces at junction/access structures. This equipment ground conductor shall also be exothermically welded to ground rods installed not more than 500 feet (150 m) apart around the circuit.

a. Counterpoise Installation Above Multiple Conduits and Duct Banks. Counterpoise wires shall be installed above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete cone of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits shall be adequate to provide a complete cone of protection measured 22 ½ degrees each side of vertical.

Where duct banks pass under pavement to be constructed in the project, the counterpoise shall be placed above the duct bank. Reference details on the construction plans.

b. Counterpoise Installation at Existing Duct Banks. When airfield lighting cables are indicated on the plans to be routed through existing duct banks, the new counterpoise wiring shall be terminated at ground rods at each end of the existing duct bank where the cables being protected enter and exit the duct bank. The new counterpoise conductor shall be bonded to the existing counterpoise system.

108-3.7 EXOTHERMIC BONDING. Bonding of counterpoise wire shall be by the exothermic welding process. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the Engineer, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

All slag shall be removed from welds.

For welds at light fixture base cans, all galvanized coated surface areas and "melt" areas, both inside and outside of base cans, damaged by exothermic bond process shall be restored by coating with a liquid cold-galvanizing compound conforming to U.S. Navy galvanized repair coating meeting Mil. Spec. MIL-P-21035. Surfaces to be coated shall be prepared and compound applied in accordance with manufacturer's recommendations.

All buried copper and weld material at weld connections shall be thoroughly coated 6 mil of 3M “Scotchkote,” or approved equivalent, or coated with coal tar bitumastic material to prevent surface exposure to corrosive soil or moisture.

108-3.8 TESTING. The Contractor shall furnish all necessary equipment and appliances for testing the airport electrical systems and underground cable circuits before and after installation. The Contractor report all test results to the engineer. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the Engineer. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase and results meeting the specifications below must be maintained by the Contractor throughout the entire project as well as during the ensuing warranty period.

~~Earth resistance testing methods shall be submitted to the Engineer for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the Engineer. All such testing shall be at the sole expense of the Contractor.~~

For new cables connected to existing airfield circuits, megger existing cable circuit prior to installation of new cables. Furnish report and notify the Engineer of any unsatisfactory insulation resistance test results. Do not perform DC Hi-Pot Test on cables with low resistance readings. Megger and perform the DC Hi-Pot test to new cables installed prior to connection. After connections of new cables to existing cables are completed, megger the length of the new and existing cable, including the splice. Check for satisfactory insulation resistance, and perform a DC Hi-Pot test on the combined cable circuit. Furnish this report to the Engineer.

Should the counterpoise or ground grid conductors be damaged or suspected of being damaged by construction activities the Contractor shall test the conductors for continuity with a low resistance ohmmeter. The conductors shall be isolated such that no parallel path exists and tested for continuity. The Engineer shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

After installation, the Contractor shall test and demonstrate to the satisfaction of the Engineer the following:

a. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.

b. That all affected circuits (existing and new) are free from unspecified grounds.

c. That the insulation resistance to ground of all new non-grounded series circuits or cable segments is not less than 50 megohms.

d. That the insulation resistance to ground of all non-grounded conductors of new multiple circuits or circuit segments is not less than 50 megohms.

e. That all affected circuits (existing and new) are properly connected in accordance with applicable wiring diagrams.

f. That all affected circuits (existing and new) are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.

g. That the impedance to ground of each ground rod does not exceed 25 ohms prior to establishing connections to other ground electrodes. The fall-of-

potential ground impedance test shall be utilized, as described by ANSI/IEEE Standard 81, to verify this requirement.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the Engineer. Where connecting new cable to existing cable, ground resistance tests shall be performed on the new cable prior to connection to the existing circuit.

There are no approved "repair" procedures for items that have failed testing other than complete replacement.

MATERIAL REQUIREMENTS

AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle Cable Connectors
FED SPEC J-C-30	Cable and Wire, Electrical Power, Fixed Installation (cancelled; replaced by A-A-59544 Cable and Wire, Electrical (Power, Fixed Installation))
FED SPEC A-A-55809	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic
ASTM B 3	Soft or Annealed Copper Wire
ASTM D 4388	Rubber tapes, Nonmetallic Semiconducting and Electrically Insulating

REFERENCE DOCUMENTS

NFPA No. 70	National Electrical Code (NEC)
MIL-S-23586C	Sealing Compound, Electrical, Silicone Rubber
	Building Industry Consulting Service International (BICSI)
ANSI/IEEE Std 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

END OF ITEM L-108

69-2 METHOD OF MEASUREMENT

Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet (meters) of cable or counterpoise wire installed in trenches, duct bank or conduit, including ground rods and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate

measurement shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. The measurement for this item shall not include additional quantities required for slack.

~~Cable and counterpoise slack is considered incidental to this item and is included in the contractor's unit price. No separate measurement or payment will be made for cable or counterpoise slack.~~

The cost of all excavation, backfill, dewatering and restoration regardless of the type of material encountered shall be included in the unit price bid for the work.

69-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for trenching, cable and bare counterpoise wire installed in trench (direct-buried), or cable and equipment ground installed in duct bank or conduit, in place by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Trenching and backfilling will not be measured for payment but will be considered incidental to the associated bid item.

Payment will be made under:

~~Item L-108-5.1 Trenching for direct-buried cable – per linear foot (meter)~~

Item 69.1 L824 Cable, 1/C #[ ] AWG, 5000 kV, Type C
in [Duct] [or] [Conduit] ..... per linear foot

Item 69.2 1/C, Green #6 AWG Type THWN
Ground Wire ..... per linear foot

Item 69.3 Bare Copper, Green #6 AWG Counterpoise
Ground Wire ..... per linear foot

~~Item L-108-5.3 Bare Counterpoise Wire, installed in trench, duct bank or conduit, including ground rods and ground connectors – per linear foot (meter)~~

~~Item L-108-5.4 Bare or insulated equipment ground, installed in duct bank or conduit including ground rods and ground conductors – per linear foot (meter).~~

END OF SECTION 69

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Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. Consists of furnishing and installing power cables within conduit or duct banks.
2. The Electrical Contractor and Job Superintendent shall have verifiable five years minimum of airfield electrical construction experience.

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. Airport lighting equipment covered by (FAA) specifications shall be approved
2. All other equipment shall be subject to acceptance
3. Manufacturer's certifications shall not relieve the Contractor
4. All materials and equipment used to construct this item shall be submitted
5. The data submitted shall be sufficient
6. All equipment under this section shall be guaranteed for twelve (12) months

B. CABLE

1. Underground cable for airfield lighting shall conform to AC 150/5345 7
2. ~~Wire for electrical circuits up to 600 volts shall comply with Specification L-824 and/or Federal Specification J-C-30 and shall be type THWN-2~~ Underground cable for airfield lighting circuits shall be single conductor No. 8 AWG or No. 6 AWG cable with 5,000 volt, cross-linked polyethylene insulation suitable for wet and dry locations.
3. Other cable type, size, number of conductors, strand and service voltage shall be as specified on the plans.

C. BARE COPPER WIRE (COUNTERPOISE OR GROUND) AND GROUND RODS

1. Wire for counterpoise or ground installations shall conform to ASTM B3 and B8.
2. The Contractor shall install a continuous electrical grounding system throughout
3. Ground rods shall be constructed of copper

D. CABLE CONNECTIONS

1. In-line connections of underground primary cables shall be
   a) ~~The Cast Splice.~~
   b) Field attached Plug in Splice.
   c) The Factory Molded Plug in Splice.
   d) ~~The Taped or Heat-Shrinked Splice.~~
2. SPLICER QUALIFICATIONS
   a) Every airfield lighting cable splicer shall be qualified
3. CONCRETE
   a) Concrete for cable markers shall conform to Specification Item P-610,
4. ~~FLOWABLE BACKFILL~~
5. CABLE IDENTIFICATION TAGS
   a) ~~Cable identification tags shall by made from a non-corrosive~~ Cable identification tags shall be copper, circular in shape two (2) inches in diameter
6. TAPE
   a) Electrical tapes shall be Scotch Electrical Tapes
7. ELECTRICAL COATING
   a) Scotchkote or approved equivalent.
8. EXISTING CIRCUITS
   a) the circuit's insulation resistance shall be tested

III. CONSTRUCTION METHODS

A. GENERAL

1. All cable required to cross under pavements shall be installed encased duct banks.

2. Cable connections between lights will be permitted only at the light locations
3. L-823 cable connectors shall be installed at locations shown on the plans.
4. Provide not less than ~~3~~ five (5) feet of cable slack on each side of all connections
5. Each new field lighting cable shall be permanently tagged
6. Work shall consist of furnishing and installing new cables, or removing and reinstalling existing cables
7. All primary cable and secondary wiring shall be made by means of factory-attached plug-in connector kits

B. INSTALLATION IN NEW DUCT BANKS OR CONDUITS

1. installation of the cable in duct banks or conduit
2. The Contractor shall make no connections or splices of any kind in cables
3. Unless otherwise designated in the plans, use the lowest ducts to receive the cable first.
4. Duct banks or conduits shall be installed as a separate item
5. The manufacturer's minimum bend radius shall apply.
6. Cable shall not be dragged across base can or manhole edges, pavement or earth.

C. INSTALLATION OF NEW CABLES IN EXISTING OCCUPIED CONDUIT

1. Existing cable(s) occupying existing conduit in which new cable is to be added shall be disconnected and pulled back to the new cable pulling point.
2. The contractor shall furnish all necessary equipment, materials and labor for testing the underground cable circuits after installation.

D. ~~**108-3.3 INSTALLATION OF DIRECT-BURIED CABLE IN TRENCHES**~~

E. ~~**108-3.4 CABLE MARKERS FOR DIRECT-BURIED CABLE.**~~

F. SPLICING

1. Connections shall be made by experienced personnel engaged five (5) years
   ~~a) Cast Splices.~~
   b) Field attached Plug in Splices
   c) Factory Molded Plug in Splices
   ~~d) Taped or Heat-Shrinked Splices~~

G. BARE COUNTERPOISE WIRE INSTALLATION FOR LIGHTNING PROTECTION AND GROUNDING

1. Install a continuous electrical grounding system throughout
2. Bare counterpoise copper wire shall be installed
3. The counterpoise wire shall be routed to each light fixture base
4. The counterpoise system shall be continuous
5. Separate equipment ground system shall be provided
   a) A ground rod installed each light fixture base.
   b) Install an insulated equipment ground conductor internal to the conduit
6. Counterpoise Installation
   a) Counterpoise wires shall be installed above multiple conduits/duct banks
   b) duct banks under pavement, the counterpoise shall above the duct bank.
7. Counterpoise Installation at Existing Duct Banks
   a) New counterpoise wiring shall be terminated at ground rods

H. EXOTHERMIC BONDING

1. Bonding of counterpoise wire shall be by the exothermic welding process.
2. Contractor shall demonstrate the welding kits, to be used for welded connections
3. All galvanized coated surface areas and "melt" areas, shall be restored.
4. All buried copper and weld material at weld connections shall be thoroughly coated

I. TESTING

1. The Contractor shall furnish all necessary equipment and appliances.
2. ~~Earth resistance testing methods shall be submitted to the Engineer for approval~~
3. Megger existing cable circuit prior to installation of new cables.
4. The Contractor shall test grid conductors for continuity
5. After installation, the Contractor shall test and demonstrate the following:
   a) Lighting power and control circuits free from short circuits.

b) Circuits free from unspecified grounds.
c) Insulation resistance series circuits is not less than 50 megohms.
d) Insulation resistance of new multiple circuits is not less than 50 megohms.
e) Circuits (existing and new) are properly connected
f) Circuits (existing and new) are operable.
g) Impedance to ground of each ground rod does not exceed 25

6. Two copies of tabulated results of all cable tests
7. There are no approved "repair" procedures for items that have failed testing other than complete replacement.

IV. MATERIAL REQUIREMENTS

A. AC 150/5345-7
B. AC 150/5345-26
C. A-A-59544
D. FED SPEC A-A-55809
E. ASTM B 3
F. ASTM D 4388

V. REFERENCE DOCUMENTS

A. NFPA NO. 70
B. MIL-S-23586C
C. ANSI/IEEE STD 81

VI. METHOD OF MEASUREMENT

A. Shall be measured by the number of linear feet of cable or counterpoise wire installed in trenches, duct bank or conduit, including ground rods and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory
B. ~~Cable and counterpoise slack is considered incidental to this item~~

VII. BASIS OF PAYMENT

A. Payment will be made at the contract unit price for trenching, cable and bare counterpoise wire installed in trench (direct-buried), or cable and equipment ground installed in duct bank or conduit
B. Payment will be made under:

1. ~~Item L-108-5.1 Trenching for direct-buried cable – per linear foot~~
2. Item 69.1 L824 Cable, 1/C # [8 or 6] AWG, 5000 kV, Type C in [Duct] [or] [Conduit] - per linear foot
3. Item 69.2 1/C, Green #6 AWG Type THWN Ground Wire - per linear foot
4. Item 69.3 Bare Copper, #6 AWG Counterpoise Ground Wire - per linear foot
5. ~~Item L-108-5.3 Bare Counterpoise Wire~~
6. ~~Item L-108-5.4 Bare or insulated equipment ground~~

END OF SECTION

SECTION 70 – AIRPORT TRANSFORMER VAULT AND VAULT EQUIPMENT
(FAA L-109)

70-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of transformer vault for airfield electrical service in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item L-109, as included and modified hereafter, and as shown on the Plans.

ITEM L-109 AIRPORT TRANSFORMER VAULT AND VAULT EQUIPMENT

DESCRIPTION

109-1.1 This item shall consist of constructing an airport transformer vault or a prefabricated metal housing these specifications in accordance with the design and dimensions shown in the plans. This work shall also include the installation of conduits in floor and foundation, painting and lighting of the vault or metal housing, and the furnishing of all incidentals necessary to produce a completed unit. Included as a separate part under this item or as a separate item where an existing vault is to be utilized shall be the furnishing of all vault equipment, wiring, electrical buses, cable, conduit, potheads, and grounding systems. This work shall also include the painting of equipment and conduit; the marking and labeling of equipment and the labeling or tagging of wires; the testing of the installation; and the furnishing of all incidentals necessary to place it in operating condition as a completed unit to the satisfaction of the Engineer.

Because of the specialized nature of the work, the Electrical Contractor and Job Superintendent shall have verifiable five years minimum of airfield electrical construction experience

EQUIPMENT AND MATERIALS

109-2.1 GENERAL.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be ~~certified and listed~~ approved under the Airport Lighting Equipment Certification Program described in Advisory Circular (AC) 150/5345-53, Airport ~~Lighting Equipment Certification Program~~ current version, as well as approved by a City of Los Angeles Recognized Electrical Field Testing Agency.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog

sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. ~~[The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section.]~~ The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner

109-2.2 CONCRETE. The concrete for the vault shall be proportioned, placed, and cured in accordance with Item P-610, Structural Portland Cement Concrete, using ¾-inch (18 mm) maximum size coarse aggregate.

109-2.3 REINFORCING STEEL. Reinforcing steel bars shall be intermediate or structural grade deformed-type bars and shall meet the requirements of ASTM A 615.

109-2.4 BRICK. Brick shall conform to ASTM C 62, Grade SW.

109-2.5 RIGID STEEL CONDUIT. Rigid steel conduit and fittings shall be in accordance with Underwriters Laboratories Standard 6 and 514.

109-2.6 LIGHTING. Vault or metal-housing light fixtures shall be of a vaporproof type, with RFI suppressors and RF type lenses for reduction of lamp radiation.

109-2.7 OUTLETS. Convenience outlets shall be 20A, heavy-duty duplex units designed for industrial service with stainless steel cover plates and meet all the requirements of the California Electrical Code, and Los Angeles Electrical Code, current versions.

109-2.8 SWITCHES. ~~Vault or metal-housing light switches shall be single-pole switches.~~ Light or fixture switches shall be heavy-duty single-pole units designed for industrial service with stainless steel cover plates and meet all the requirements of the California Electrical Code, and Los Angeles Electrical Code, current versions.

109-2.9 PAINT.

a. Priming paint for ungalvanized metal surfaces shall be a high solids alkyd primer conforming to TT-P-664D.

b. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2.

c. Priming paint for wood surfaces shall be mixed on the job by thinning the above specified white paint by adding 1/2 pint (0.06 liter) of raw linseed oil to each gallon (liter).

d. Paint for the floor, ceiling, and inside walls shall be in accordance with Fed. Spec. TT-E-487. Walls and ceiling shall be light blue and the floor shall be medium gray.

e. The roof coating shall be ~~hot asphalt material in accordance with ASTM D 2823~~ a thermo plastic membrane type roofing.

109-2.10 HIGH VOLTAGE BUS. High-voltage bus shall be standard weight 3/8-inch (9 mm) IPS copper tubing of the size and voltage rating specified.

109-2.11 BUS CONNECTORS. Connectors shall be similar to Burndy Type NT (or equivalent) for copper tubing. Connectors for insulated bus cable shall be of the proper size and type for the service intended.

109-2.12 BUS SUPPORTS. Bus supports shall be similar to Westinghouse No. 527892 (or equivalent), insulated for 7,500 volts, single clamp type for 2-bolt flat mounting.

109-2.13 GROUND BUS. Ground bus shall be 1/8 - x ¾-inch (3 x 18 mm) minimum copper bus bar.

109-2.14 SQUARE DUCT. Duct shall be square similar to that manufactured by the Square D Company (or equivalent), or the Trumbull Electric Manufacturing Company (or equivalent). The entire front of the duct on each section shall consist of hinged or removable cover for ready access to the interior. The cross section of the duct shall be not less than 4 x 4 inches (100 x 100 mm) except where otherwise shown in the plans.

109-2.15 GROUND RODS. Ground rods shall be copper or copper-clad of the length and diameter specified in the plans.

109-2.16 POTHEADS. Potheads shall be similar to G&W Type N, Shape C (or equivalent), unless otherwise specified. Potheads shall be furnished with plain insulator bushings and conduit couplings. Potheads shall have a rating not less than the circuit voltage.

109-2.17 PREFABRICATED METAL HOUSING. The prefabricated metal housing shall be a commercially available unit.

109-2.18 EMERGENCY GENERATORS. Emergency generators shall be diesel powered, sized according to plan and capable of supporting all airfield lighting and emergency vault equipment. Generators shall meet all requirements indentified for Emergency Generators in NFPA 110.

109-2.19 CONSTANT CURRENT REGULATORS

a. Constant Current Regulators (CCR) shall conform to the requirements of FAA Advisory Circular Number 150/5345-10, Latest Edition "Specification for Constant Current Regulators and Regulator Monitors."

b. Constant Current Regulators shall be: Type L-828, Regulator, Class 1, 6.6 amperes; Style 1, three brightness steps. Constant Current Regulators shall be suitable for connection to a 208 volt, 1 phase, and 60 Hertz supply. Constant Current Regulators shall be air-cooled ferroresonant dry type of the

Kilowatt rating indicated on the Plans. SCR type regulators are not acceptable. CCR shall be as manufactured by Hevi-Duty to match existing CCR or approved equal.

c. Provide integral multi step local control switch, ammeter, lightning and surge protection on input and output lines, open circuit protection and indication, over current protection and indication.

d. Constant Current Regulator minimum input power factor shall be 95 percent when measured on the highest intensity setting.

e. Constant Current Regulator minimum efficiency shall be 90 percent when measured on the highest intensity setting.

f. The regulators shall be suitable for remote control from a 120 volt control source and shall be capable of remote reset.

g. Provide with interface for the ALCMS from remote locations. Existing monitoring system is manufactured by Crouse-Hinds Airport Lighting Products. CCR shall be provided with dry contacts for 'local' and 'remote' positions.

h. Install floor mounted regulators within the Airfield Lighting Vault at the locations indicated. Interconnect equipment and devices to provide a complete installation.

i. Install and adjust in accordance with manufacturers' requirements. Install all conductors in conduit.

j. Demonstrate the operation of all features of the system.

109-2.20 FAA-APPROVED EQUIPMENT. Certain items of airport lighting equipment installed in vaults are covered by individual FAA equipment specifications. The specifications are listed below:

AC 150/5345-3 Specification for L-821 Panels for Remote Control of Airport Lighting

AC 150/5345-5 Circuit Selector Switch

AC 150/5345-7 Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits

AC 150/5345-10 Specification for Constant Current Regulators and Regulator Monitors

AC 150/5345-13 Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits.

109-2.21 OTHER ELECTRICAL EQUIPMENT. Constant-current regulators, distribution transformers, ~~oil switches,~~ cutouts, relays, terminal blocks, transfer relays, circuit breakers, emergency generators and all other regularly used commercial items of electrical equipment not directly covered and or required by FAA equipment specifications shall conform to the applicable rulings and standards of the Institute of Electrical and Electronic Engineers or the National Electrical Manufacturers Association. ~~When specified,~~ Test reports from ~~a testing laboratory~~ an approved City of Los Angeles Recognized Electrical Field Testing Agency, indicating that the

equipment meets the specifications and local city requirements, shall be supplied. In all cases, equipment shall be new and a first-grade product. This equipment shall be supplied in the quantities required for the specific project and shall incorporate the electrical and mechanical characteristics specified in the proposal and plans.

109-2.22 WIRE. Wire in conduit rated up to 5,000 volts shall conform to AC 150/5345-7, Specification for L-824 Underground Electrical Cables for Airport Lighting Circuits, as indicated in Specification section S69, for rubber insulated neoprene-covered wire, or Fed. Spec. J-C-30, Type RHW, for rubber insulated fibrous-covered wire. For ratings up to 600 volts, thermoplastic wire conforming to Fed. Spec. J-C-30, Type THWN, shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

a. Control Circuits. Unless otherwise indicated on the plans, wire shall be not less than No. 12 AWG and shall be insulated for 600 volts. ~~If~~ Where telephone control cable is specified, No. 19 AWG telephone cable conforming to ICEA S-85-625-1996 specifications shall be used. Fiber Optic lines, splices, patch panels and terminations shall meet with the requirements of Specification Section 77.

b. Power Circuits.

(1) 600 volts maximum-Wire shall be No. ~~6~~ 12 AWG or larger and insulated for at least 600 volts.

(2) ~~3,000 volts maximum-Wire shall be No. 6 AWG or larger and insulated for at least 3,000 volts.~~ Over 600 volts-Wire shall be No. 8 AWG or larger and insulated for at least the circuit voltage.

~~**(3)** Over 3,000 volts-Wire shall be No. 6 AWG or larger and insulated for at least the circuit voltage.~~

CONSTRUCTION METHODS

109-3.1 GENERAL. The Contractor shall construct the transformer vault or prefabricated metal housing at the location indicated in the plans. Vault construction shall be reinforced concrete and concrete masonry block ~~or brick wall~~ as specified. The metal housing shall be prefabricated equipment enclosure to be supplied in the size specified. The mounting pad or floor details, installation methods, and equipment placement are shown in the plans.

The Contractor shall clear, grade, and seed the area around the vault or metal housing for a minimum distance of 10 feet (3 m) on all sides. The slope shall be not less than ½-inch per foot (40 mm per m) away from the vault or metal housing in all directions.

The vault shall provide adequate protection against weather elements, including rain, wind-driven dust, ~~snow, ice~~ and excessive heat. The vault shall have sufficient filtered ventilation, to assure that the interior room temperatures and conditions do not exceed the recommended limits of the electrical equipment to be installed in the vault. Contractor is responsible for contacting the manufacturer of the equipment to be installed to obtain environmental limitations of the equipment to be installed.

109-3.2 FOUNDATION AND WALLS.

a. Reinforced Concrete Construction. The Contractor shall construct the foundation and walls in accordance with the details shown in the plans. Unless otherwise specified, internal ties shall be of the mechanical type so that when the forms are removed the ends of the ties shall be at least 1-inch (25 mm) beneath the concrete surface; the holes shall be plugged and finished to prevent discoloration. Reinforcing steel shall be placed, as shown in the drawings, and secured in position to prevent displacement during the concrete placement.

The external surfaces of the concrete shall be thoroughly worked during the placing operation to force all coarse aggregate from the surface. Thoroughly work the mortar against the forms to produce a smooth finish free from air pockets and honeycomb.

The surface film of all pointed surfaces shall be removed before setting occurs. As soon as the pointing has set sufficiently, the entire surface inside and outside of the vault shall be thoroughly wet with water and rubbed with a No. 16 carborundum stone, or equivalent quality abrasive, bringing the surface to a paste. All form marks and projections shall be removed. The surface produced shall be smooth and dense without pits or irregularities. The materials which have been ground into a paste during the rubbing process shall be spread or brushed uniformly over the entire surface (except the interior surfaces that are to be painted shall have all paste removed by washing before painting) and permitted to reset. Final exterior finish shall be obtained by rubbing with No. 30 carborundum stone, or an equivalent quality abrasive. The surface shall be rubbed until the entire surface is smooth and uniform in color.

~~**b. Brick and Concrete Construction.** When this type of construction is specified, the foundation shall be concrete conforming to the details shown in the plans. The outer edge of the foundation at the floor level shall be beveled 1-½ inches (37 mm) at 45 degrees. Brick walls shall be 8 inches (200 cm) thick, laid in running bond with every sixth course a header course. Brick shall be laid in cement mortar (1 part masonry cement and 3 parts sand) with full mortar bed and shoved joints. All joints shall be completely filled with mortar, and facing brick shall be back-parged with mortar as work progresses. All joints shall be 3/8 inch (9 mm) thick, exterior joints tooled concave, and interior joints struck flush. Both interior and exterior brick surfaces shall be cleaned and nail holes, cracks and other defects filled with mortar. When specified, a nonfading mineral pigment mortar coloring shall be added to the mortar. Steel reinforcing bars, 3/8 inch (9 mm) in diameter and 12 inches (300 mm) long, shall be set vertically in the center of the brick wall on not more than 2 foot (60 cm) centers to project 2-½(60 mm) inches into the concrete roof slab. Lintels for supporting the brickwork over doors, windows, and louvers shall consist of two 4 x 3 x 3/8 inch (100 x 75 x 9 mm) steel angles. Lintels shall be painted with one coat of corrosion inhibiting primer before installation, and all exposed parts shall be painted similar to doors and window sash after installation.~~

~~Window sills may be concrete poured in place or precast concrete as indicated in the plans. All exposed surfaces shall have a rubbed finish as specified under reinforced concrete construction. After completion, all interior and exterior faces of walls shall be scrubbed with a solution of muriatic acid and water in the proportions of not less than 1 part acid to 10 parts of water. All traces of efflorescence, loose mortar, and mortar stain shall be removed, and the walls washed down with clear water.~~

c. Concrete Masonry Construction. When this type of construction is specified, the foundation shall be concrete conforming to the details shown in the plans. The concrete masonry units shall be standard sizes and shapes and shall conform to ASTM C 90 and shall

include the closures, jambs, and other shapes required by the construction as shown in the plans. Standard construction practice shall be followed for this type of work including mortar, joints, reinforcing steel for extensions into roof slab, etc. ~~Plaster for interior walls, if specified, shall be portland cement plaster.~~

109-3.3 ROOF. The roof shall be corrugated metal with ~~reinforced~~ concrete as shown in the plans. ~~Reinforcing steel shall be placed as shown in the drawing and secured in position to prevent displacement during the pouring of the concrete.~~ The concrete shall be poured monolithically and shall be free of honeycombs and voids. The surface shall have a steel-troweled finish and shall be sloped as shown in the drawing. The underside of the roof slab shall be finished in the same manner as specified for walls.

~~One brush or mop coat of hot asphalt roof coating shall be applied to the top surface of the roof slab. The asphalt material shall be heated to within the range specified by the manufacturer and immediately applied to the roof. The finished coat shall be continuous over the roof surface and free from holidays and blisters. Smears and dribbles of asphalt on the roof edges and building walls shall be removed.~~

The Feltback PVC Thermoplastic roofing membrane with flashings and other components to comprise a roofing system, shall be applied only by a Roofing Contractor authorized by the manufacturer prior to bid ("Applicator"). The Roofing Contractor shall have at least five (5) years of experience as an applicator with the submitted manufacturer as certified by the manufacturer.

109-3.4 FLOOR. The floor shall be reinforced concrete as shown in the drawings. When present, all sod, roots, refuse, and other perishable material shall be removed from the area under the floor to a depth of 8 inches (200 mm), unless a greater depth is specified in the invitation for bids. This area shall be backfilled with materials consisting of sand, cinders, gravel, or stone. Fill shall be placed in layers not to exceed 4 inches (100 mm) and shall be thoroughly compacted by tamping or rolling. A layer of building paper shall be placed over the fill prior to placing concrete. The floor surfaces shall have a steel-troweled finish. The floor shall be level unless a drain is specified, in which case the floor shall be pitched ¼-inch (6 mm) per foot downward toward the drain. A ¼-inch (6 mm) asphalt felt expansion joint shall be placed between floor and foundation walls. The floor shall be poured monolithically and shall be free of honeycombs and voids.

109-3.5 FLOOR DRAIN. ~~If shown in the plans,~~ A floor drain and sump pump well shall be installed in the center of the floor of the equipment room. ~~The dry well shall be excavated 4 x 4 feet (120 x 120 cm) square and to a depth of 4 feet (120 cm) below the finished floor elevation and shall be backfilled to the elevation of the underside of the floor with gravel - which shall all pass a 2-inch (50 mm) mesh sieve and shall all be retained on a ¼ inch (6 mm) mesh sieve. The gravel backfill shall be placed in 6-inch (150 mm) maximum layers, and the entire surface of each layer shall be tamped either with a mechanical tamper or with a hand tamper weighing not less than 25 pounds (11 kg) and having a face area of not more than 36 square inches (234 square cm) nor less than 16 square inches (104 square cm).~~ The drain inlet shall be set flush in the concrete floor. The drain shall have a clear opening of not less than 8 inches (200 mm) in diameter.

109-3.6 CONDUITS IN FLOOR AND FOUNDATION. Conduits shall be installed in the floor and through the foundation walls in accordance with the details shown in the plans. All underground conduit shall be painted with a bituminous compound. Conduit shall be installed with a coupling or metal conduit adapter flush with the top of the floor. All incoming conduit shall be closed

with a pipe plug to prevent the entrance of foreign material during construction. Space conduit entrances shall be left closed.

109-3.7 DOORS. Doors shall be metal-clad fireproof class a doors conforming to requirements of the National Electric Code and local electrical codes.

109-3.8 PAINTING. The floor, ceiling, and inside walls of concrete construction shall first be given a hardening treatment, after which the Contractor shall apply two coats of paint as specified below. The hardening treatment shall consist of applying two coats of either a commercial floor hardener or a solution made by dissolving 2 pounds (0.9 kg) of magnesium fluosilicate or zinc sulphate crystals in 1 gallon (liter) of water. Each coat shall be allowed to dry at least 48 hours before the next application. After the second treating coat has dried, the surfaces shall be brushed clean of all crystals and thoroughly washed with clear water. Paint for walls and ceiling shall be a light blue color approved by owner. The floor paint shall be a medium gray color approved by the Engineer. Before painting, the surfaces shall be dry and clean. The first coat shall be thinned by adding 2/3-quart (0.166 liters) of spar varnish and 1/3-quart (0.083 liters) of turpentine to each gallon (liter) of paint. The second coat shall be applied without thinning. All doors, lintels, and windows shall be cleaned to remove any rust or foreign material and shall be given one body and one finish coat of white paint. Bare metal surfaces shall be given a prime coat of corrosion-inhibiting primer prior to the body and finish coats.

109-3.9 LIGHTS AND SWITCHES. The Contractor shall furnish and install a minimum of ~~two~~ four duplex convenience outlets in the vault room, or as specified on the plans, whichever is greater. Where a control room is specified, at least ~~two~~ six duplex outlets shall be installed.

109-3.10 EMERGENCY GENERATOR. The Contractor shall furnish and install Emergency Generator as specified on the plans. Generators shall be installed on 4" raised equipment pads with vibration isolators, outdoor above ground diesel tank and a veeder root leak detection system.

108-3.8 TESTING. The Contractor shall furnish all necessary equipment and appliances for testing the vault electrical systems and circuits before and after installation. The Contractor shall report all tests to the Engineer. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the Engineer. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase and results meeting the specifications below must be maintained by the Contractor throughout the entire project as well as during the ensuing warranty period.

Earth resistance testing methods shall be submitted to the Engineer for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the Engineer. All such testing shall be at the sole expense of the Contractor.

Should any part of the electrical system be damaged or suspected of being damaged by construction activities the Contractor shall test the system for continuity. The Engineer shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the Engineer. Where connecting new cable to existing cable, ground resistance tests shall be performed on the new cable prior to connection to the existing circuit.

There are no approved "repair" procedures for items that have failed testing other than complete replacement.

INSTALLATION OF EQUIPMENT IN VAULT OR PREFABRICATED METAL HOUSING

109-3.10 GENERAL. The Contractor shall furnish, install, and connect all equipment, equipment accessories, conduit, cables, wires, buses, grounds, and support necessary to insure a complete and operable electrical distribution center for the airport lighting system as specified herein and shown in the plans. When specified, an emergency power supply and transfer switch shall be provided and installed.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and local code agency having jurisdiction.

109-3.11 POWER SUPPLY EQUIPMENT. Transformers, regulators, booster transformers, and other power supply equipment items shall be furnished and installed at the location shown in the plans or as directed by the Engineer. ~~The power supply equipment shall be set on steel "H" sections, "I" beams, channels, or concrete blocks to provide a minimum space of 1 ½ inches (37 mm) between the equipment and the floor. The equipment shall be placed so as not to obstruct the oil sampling plugs of the oil filled units; and name plates shall, so far as possible, not be obscured.~~

~~If specified in the plans and specifications,~~ Equipment for an ~~alternate power source or~~ emergency power generator shall be furnished and installed. The alternate power supply installation shall include all equipment, accessories, an automatic transfer switch, and all necessary wiring and connections. The emergency power generator set shall be the size and type specified.

109-3.12 SWITCHGEAR AND PANELS. ~~Oil switches,~~ Fused cutouts, relays, transfer switches, panels, panel boards, and other similar items shall be furnished and installed at the location shown in the plans or as directed by the Engineer. Wall or ceiling mounted items shall be attached to the wall or ceiling with galvanized bolts of not less than 3/8-inch (9 mm) diameter engaging metal expansion shields or anchors in masonry or concrete vaults.

109-3.13 DUCT AND CONDUIT. ~~The Contractor shall furnish and install square type exposed metallic ducts with hinged covers for the control circuits in the vault. These shall be mounted along the walls behind all floor mounted equipment and immediately below all wall mounted equipment. The hinged covers shall be placed to open from the front side with the hinges at the front bottom.~~

~~Wall brackets for square ducts shall be installed at all joints 2 feet (60 cm) or more apart with intermediate brackets as specified. Conduit shall be used between square ducts and equipment or between different items of equipment when the equipment is designed for conduit connection. When the equipment is not designed for conduit connection, conductors shall enter the square type control duct through insulating bushings in the duct or on the conduit risers.~~
Rigid Metal Conduit shall be installed in the walls and concrete wherever possible. When the equipment is not designed for rigid metal conduit connections, liquid tight flexible metallic tubing shall be used through insulating bushings in the equipment.

109-3.14 CABLE ENTRANCE AND HIGH-VOLTAGE BUS SYSTEM. Incoming underground cable from field circuits and supply circuits will be installed outside the walls of the transformer vault as a separate item under Item L-108. The Contractor installing the vault equipment shall bring the cables from the trench or duct through the entrance conduits into the vault and make the necessary electrical connections. For the incoming and outgoing high voltage load circuits, the Contractor shall furnish and install rigid metallic ~~vi~~ conduit ~~risers, surmounted by potheads, from floor level to the level as shown in the plans.~~

The incoming high-voltage power supply service to the vault shall enter below the floor of the vault and shall rise from the floor level in a rigid metallic conduit riser, surmounted by a pothead~~, as described above~~. Using insulated high-voltage cable, the incoming power service shall be connected from the pothead to the ~~oil fused cutouts or to the~~ specified disconnecting switch or equipment. From the ~~oil fused cutouts or to the specified~~ disconnecting device, the insulated service conductors shall be connected to the main ~~overhead voltage~~ bus system of the vault. The high-voltage bus system shall utilize the materials specified and shall be mounted and installed in accordance with the requirements of the National Electrical Code or the local code agency having jurisdiction.

109-3.15 WIRING AND CONNECTIONS. The Contractor shall make all necessary electrical connections in the vault in accordance with the wiring diagrams furnished and as directed by the Engineer. In wiring to the terminal blocks, the Contractor shall leave sufficient extra length on each control lead to make future changes in connections at the terminal block. This shall be accomplished by running each control lead the longest way around the box to the proper terminal. Leads shall be neatly laced in place.

109-3.16 MARKING AND LABELING. All equipment, control wires, terminal blocks, etc., shall be tagged, marked, or labeled as specified below:

a. Wire Identification. The Contractor shall furnish and install self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks. Wire labels, if used, shall be of the self-sticking preprinted type and of the manufacturer's recommended size for the wire involved. Identification -markings designated in the plans shall be followed. Tags, if used, shall be of fiber not less than ¾-inch (13 mm) in diameter and not less than 1/32-inch (1 mm) thick. Identification markings designated in the plans shall be stamped on tags by means of smalltool dies. Each tag shall be securely tied to the proper wire by a nonmetallic cord.

b. Labels. The Contractor shall stencil identifying labels on the cases of regulators, breakers, and distribution and control relay cases with ~~white oil paint as designated by the Engineer~~ metal, non-corrosive nameplates. The letters and numerals shall be stamped, and not less than ~~1~~ 3/4 inch ~~(25 mm)~~ in height and shall be of proportionate width. The Contractor shall also mark the correct circuit designations in accordance with the wiring diagram on the terminal marking strips, which are a part of each terminal block.

METHOD OF MEASUREMENT

109-4.1 See Section 69-2 The quantity of vaults to be paid for under this item shall consist of the number of vaults constructed in place and accepted as a complete unit.

109-4.2 The quantity of prefabricated metal housings to be paid for under this item shall consist of the number of housings constructed in place and accepted as a complete unit.

109-4.3 The quantity of vault or prefabricated metal housing equipment to be paid for under this item shall consist of all equipment installed, connected, and accepted as a complete unit ready for operation.

BASIS OF PAYMENT

109-5.1 See Section 69-3. ~~Payment will be made at the contract unit price for each completed and accepted vault or prefabricated metal housing equipment installation. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.~~

~~Payment will be made under:~~

~~Item L-109-5.1 Construction of Airport Transformer Vault in Place per unit~~

~~Item L-109-5.2 Installation of Airport Transformer Vault Equipment in Place per unit~~

~~Item L-109-5.3 Construction of Prefabricated Metal Housing and Foundation in Place per unit~~

~~Item L-109-5.4 Installation of Prefabricated Metal Housing Equipment in Place per unit~~

MATERIAL REQUIREMENTS

AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle Cable Connectors
FED SPEC J-C-30	Cable and Wire, Electrical Power, Fixed Installation (cancelled; replaced by A-A-59544 Cable and Wire, Electrical (Power, Fixed Installation))
FED SPEC A-A-55809	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic
ASTM B 3	Soft or Annealed Copper Wire
ASTM D 4388	Rubber tapes, Nonmetallic Semiconducting and Electrically Insulating

REFERENCE DOCUMENTS

NFPA No. 70	National Electrical Code (NEC)

MIL-S-23586C	Sealing Compound, Electrical, Silicone Rubber
	Building Industry Consulting Service International (BICSI)
ANSI/IEEE Std 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

END OF ITEM L-109

70-2 METHOD OF MEASUREMENT

Vault equipment shall be measured by the number of linear feet, square feet and per each for each piece of equipment specified in the vault. To include but be limited to; concrete, concrete masonry units, reinforcing steel, rigid steel conduit, lighting, outlets, switches, paint, high-voltage bus, bus connectors, bus supports, ground bus, square duct, ground rods, potheads, prefabricated metal housing, panels, switchboards, transformers, regulators and wire.

70-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for concrete, concrete masonry units, reinforcing steel, rigid steel conduit, lighting, outlets, switches, paint, high-voltage bus, bus connectors, bus supports, ground bus, square duct, ground rods, potheads, prefabricated metal housing, panels, switchboards, transformers, regulators and wire installed in place by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, necessary to complete this item.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Trenching and backfilling will not be measured for payment but will be considered incidental to the associated bid item.

END OF SECTION 70

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Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. This item shall consist of constructing an airport transformer vault or a prefabricated metal housing

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA).

2. other equipment covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance.

3. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these.

4. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment.

5. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications.

6. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner.

B. CONCRETE

1. The concrete for the vault shall be proportioned, placed, and cured in accordance with Item P-610.

C. REINFORCING STEEL

1. Reinforcing steel bars shall be intermediate or structural grade deformed-type bars and shall meet the requirements of ASTM A 615.

D. BRICK

1. Brick shall conform to ASTM C 62, Grade SW.

E. RIGID STEEL CONDUIT

1. Rigid steel conduit and fittings shall be in accordance with Underwriters Laboratories Standard 6 and 514.

F. LIGHTING

1. Vault or metal-housing light fixtures shall be of a vaporproof type.

G. OUTLETS

1. Convenience outlets shall be 20A, heavy-duty duplex units.

H. SWITCHES

1. ~~Vault or metal-housing light switches shall be single-pole switches.~~ Light or fixture switches shall be heavy-duty single-pole unit.

I. PAINT

1. Priming paint for ungalvanized metal surfaces shall be a high solids alkyd primer.

2. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint.

3. Priming paint for wood surfaces shall be mixed on the job by thinning the.

4. Paint for the floor, ceiling, and inside walls shall be in accordance with Fed. Spec.

5. The roof coating shall be ~~hot asphalt material in accordance with ASTM D 2823~~ a thermo plastic membrane type roofing.

J. HIGH VOLTAGE BUS

1. High-voltage bus shall be standard.

K. BUS CONNECTORS

1. Connectors shall be similar to Burndy Type NT for copper tubing.

L. BUS SUPPORTS

1. Bus supports shall be similar to Westinghouse.

M. GROUND BUS

1. Ground bus shall be 1/8 - x ¾-inch (3 x 18 mm) minimum copper bus bar.

N. SQUARE DUCT

1. Duct shall be square similar to that manufactured by the Square D.

O. GROUND RODS

1. Ground rods shall be copper or copper-clad of the length and diameter specified in the plans.

~~P. POTHEADS~~

1. ~~Potheads shall be similar to G&W Type N, Shape C.~~

Q. PREFABRICATED METAL HOUSING

1. The prefabricated metal housing shall be a commercially available unit.

R. EMERGENCY GENERATORS

1. Emergency generators shall be diesel powered.

S. CONSTANT CURRENT REGULATORS

1. Constant Current Regulators (CCR) shall conform to the requirements of FAA.

2. Constant Current Regulators shall be: Type L-829, Regulator.

3. Provide integral multi step local control switch.

4. Constant Current Regulator minimum input power factor shall be 95 percent.

5. Constant Current Regulator minimum efficiency shall be 90 percent.

6. The regulators shall be suitable for remote control.

7. Provide with interface for the ALCMS from remote locations..

8. Install floor mounted regulators within the Airfield Lighting Vault at the locations indicated.

9. Install and adjust in accordance with manufacturers' requirements.

10. Demonstrate the operation of all features of the system.

T. FAA-APPROVED EQUIPMENT

1. Certain items of airport lighting equipment installed in vaults are covered by individual FAA equipment specifications. The specifications are listed below:

   a) AC 150/5345-3

   b) AC 150/5345-5

   c) AC 150/5345-7

   d) AC 150/5345-10

   e) AC 150/5345-13

U. OTHER ELECTRICAL EQUIPMENT

1. Constant-current regulators, distribution transformers, ~~oil switches,~~ cutouts, relays, terminal blocks, transfer relays, circuit breakers and emergency generators.

V. WIRE

1. Wire in conduit rated up to 5,000 volts shall conform to AC 150/5345-7.

2. Control Circuits

a) Unless otherwise indicated on the plans, wire shall be not less than No. 12 AWG.

3. Power Circuits.

a) 600 volts maximum-Wire shall be No. ~~6~~ 12 AWG or larger and insulated for at least 600 volts.

b) ~~3,000 volts maximum-Wire shall be No. 6 AWG or larger and insulated for at least 3,000 volts.~~ Over 600 volts-Wire shall be No. 8 AWG or larger and insulated for at least the circuit voltage.

~~c) Over 3,000 volts-Wire shall be No. 6 AWG or larger and insulated for at least the circuit voltage.~~

III. CONSTRUCTION METHODS

A. GENERAL

1. The Contractor shall construct the transformer vault or prefabricated metal housing at the location indicated in the plans.

B. FOUNDATION AND WALLS

1. Reinforced Concrete Construction

a) The Contractor shall construct the foundation and walls in accordance with the details shown in the plans.

2. ~~Brick and Concrete Construction~~

3. Concrete Masonry Construction

a) When this type of construction is specified, the foundation shall be concrete conforming to the details shown in the plans.

C. ROOF

1. The roof shall be corrugated metal with ~~reinforced~~ concrete as shown in the plans.

D. FLOOR

1. The floor shall be reinforced concrete as shown in the drawings.

E. FLOOR DRAIN

1. ~~If shown in the plans,~~ A floor drain and sump pump well shall be installed in the center of the floor of the equipment room

F. CONDUITS IN FLOOR AND FOUNDATION

1. Conduits shall be installed in the floor and through the foundation walls in accordance with the details shown in the plans.

G. DOORS

1. Doors shall be metal-clad fireproof class a doors conforming to requirements of the National Electric Code and local electrical codes.

H. PAINTING

1. The floor, ceiling, and inside walls of concrete construction shall first be given a hardening treatment, after which the Contractor shall apply two coats of paint as specified.

I. LIGHTS AND SWITCHES

1. The Contractor shall furnish and install a minimum of ~~two~~ four duplex convenience outlets in the vault room.

J. EMERGENCY GENERATOR

1. The Contractor shall furnish and install Emergency Generator as specified on the plans.

K. TESTING

1. The Contractor shall furnish all necessary equipment and appliances for testing the vault electrical systems and circuits before and after installation.

IV. INSTALLATION OF EQUIPMENT IN VAULT OR PREFABRICATED METAL HOUSING

A. GENERAL

1. The Contractor shall furnish, install, and connect all equipment, equipment accessories, conduit, cables, wires, buses, grounds, and support necessary to insure a complete and operable electrical distribution center for the airport lighting system as specified herein and shown in the plans.

B. POWER SUPPLY EQUIPMENT

1. Transformers, regulators, booster transformers, and other power supply equipment items shall be furnished and installed at the location shown in the plans or as directed by the Engineer.

C. SWITCHGEAR AND PANELS

1. ~~Oil switches,~~ Fused cutouts, relays, transfer switches, panels, panel boards, and other similar items shall be furnished and installed at the location shown in the plans or as directed by the Engineer.

D. DUCT AND CONDUIT

1. ~~The Contractor shall furnish and install square-type exposed metallic ducts with hinged covers for the control circuits in the vault.~~ Rigid Metal Conduit shall be installed in the walls and concrete wherever possible.

E. CABLE ENTRANCE AND HIGH-VOLTAGE BUS SYSTEM

1. Incoming underground cable from field circuits and supply circuits will be installed outside the walls of the transformer vault as a separate item under Item L-108.

F. WIRING AND CONNECTIONS

1. The Contractor shall make all necessary electrical connections in the vault in accordance with the wiring diagrams furnished and as directed by the Engineer

G. MARKING AND LABELING

1. All equipment, control wires, terminal blocks, etc., shall be tagged, marked, or labeled as specified below:

H. Wire Identification

1. The Contractor shall furnish and install self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks.

I. Labels

1. The Contractor shall stencil identifying labels on the cases of regulators, breakers, and distribution and control relay cases with ~~white oil paint as designated by the Engineer~~ metal, non-corrosive nameplates.

V. METHOD OF MEASUREMENT

1. See Section 69-2 ~~The quantity of vaults to be paid for under this item shall consist of the number of vaults constructed in place and accepted as a complete unit.~~

2. ~~109-4.2 The quantity of prefabricated metal housings to be paid for under this item shall consist of the number of housings constructed in place and accepted as a complete unit.~~

3. ~~109-4.3 The quantity of vault or prefabricated metal housing equipment to be paid for under this item shall consist of all equipment installed, connected, and accepted as a complete unit ready for operation.~~

VI. BASIS OF PAYMENT

1. See Section 69-3. ~~Payment will be made at the contract unit price for each completed and accepted vault or prefabricated metal housing equipment installation. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.~~

2. ~~Payment will be made under:~~

   ~~Item L-109-5.1~~

   ~~Item L-109-5.2~~

   ~~Item L-109-5.3~~

   ~~Item L-109-5.4~~

VII. MATERIAL REQUIREMENTS

A. AC 150/5345-7

B. AC 150/5345-26

C. FED SPEC J-C-30

D. FED SPEC A-A-55809

E. ASTM B 3

F. ASTM D 4388

VIII. REFERENCE DOCUMENTS

G. NFPA No. 70

H. MIL-S-23586C

I. ANSI/IEEE Std 81

END OF ITEM L-109

SECTION 71 – AIRPORT UNDERGROUND ELECTRICAL DUCTS AND CONDUIT **(FAA L-110)**

71-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of electrical ducts and conduits for airfield electrical systems in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item L-110, as included and modified hereafter, and as shown on the Plans.

It shall also include all trenching, backfilling, removal, and restoration of any paved areas; concrete encasement (where required), mandreling installation of pulling rope and duct markers, capping, and the testing of the installation as a completed duct system ready for installation of cables, to the satisfaction of the Owner and Engineer. The Contractor shall protect the existing pavements from damage by use of any equipment with tracks, stabilization feet, hydraulic fluids, etc., during the construction of this item.

ITEM L-110 AIRPORT UNDERGROUND ELECTRICAL DUCT BANKS AND CONDUITS

DESCRIPTION

110-1.1 *This item shall consist of underground electrical conduits and duct banks (single or multiple conduits encased in concrete) installed in accordance with this specification at the locations and in accordance with the dimensions, designs, and details shown on the plans. This item shall include furnishing and installing of all underground electrical duct banks and individual and multiple underground conduits. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandreling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables in accordance with the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.*

EQUIPMENT AND MATERIALS

110-2.1 GENERAL.

a. *All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.*

b. *Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.*

c. *All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.*

d. *The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.*

e. *All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.*

~~***110-2.2 STEEL CONDUIT.*** *Rigid galvanized steel conduit and fittings shall be hot dipped galvanized inside and out and conform to the requirements of Underwriters Laboratories Standard 6, 514B, and 1242.*~~

110-2.2 PLASTIC CONDUIT. *Plastic conduit and fittings-shall conform to the requirements of Fed. Spec. W--C-1094, Underwriters Laboratories Standards UL-651 and Article 347 of the current National Electrical Code shall be one of the following, as shown on the plans:*

a. *Type I–Schedule 40 PVC suitable for underground use either direct-buried or encased in concrete.*

b. *Type II–Schedule 40 PVC suitable for either above ground or underground use.*

Non-metallic conduit and fittings shall conform to the requirements of Fed. Spec. W-C-1094 and shall be Type II, Schedule 40. Conduit shall be heavy-wall polyvinylchloride (PVC) conduit listed by an independent testing laboratory for Above Ground Exposed, Underground Concrete Encased (CE) and Underground Direct Earth Burial (DEB) for applications as described in Article 352 of the current National Electrical Code.

All joints shall be solvent welded in accordance with the recommendation of the manufacturer. The plastic conduit, fittings, expansion joints and joint adhesive/solvent shall be products of one manufacturer to assure compatibility.

The type of adhesive shall be as recommended by the conduit/fitting manufacturer.

110-2.4 SPLIT CONDUIT*. Split conduit shall be pre-manufactured for the intended purpose and shall be made of ~~steel or~~ PVC.*

110-2.5 CONDUIT SPACERS*. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads, They shall be designed to accept No. 4 reinforcing bars installed vertically.*

110-2.6 CONCRETE. *Concrete encasement with red dye shall conform to Section 54 of these Specifications (FAA Item P-610, Structural Portland Cement Concrete, ~~using [ ] inch maximum size coarse aggregate with a minimum 28 day compressive strength of [ ] psi~~). Where reinforced duct banks are specified, reinforcing steel shall conform to ASTM A 615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.*

110-2.7 FLOWABLE BACKFILL. *Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Section 24 of these specifications (FAA Item P-153) "Controlled Low Strength Material".*

110-2.8 DETECTABLE WARNING TAPE. ~~*Plastic, detectable, color as noted magnetic tape shall be polyethylene film with a metallized foil core and shall be 4-6 inches (75-150 MM) wide.*~~ *Red detectable conduit marker tape shall be inert polyethylene plastic, 4-mil thickness, impervious to all known alkalis, acids, chemical reagents, and solvents, and at least 4 inches wide with the word "ELECTRICAL" or similar imprinted on it. Contractor shall install marker tape*

over ducts, 6 inches below surface. Detectable tape is incidental to the respective bid item.

110-2.9 DUCT MARKERS. *The location of duct bank terminations shall be marked by a concrete slab marker 2 ft square and 4 inches thick extending approximately 1 inch above the surface.*

The markers shall be located above the ends of all ducts or duct banks, except where ducts terminate in a hand hole, manhole, or building. Where duct banks terminate, provide a duct marker labeled, "DUCT ENDS". He shall also impress on the slab the number and size of conduit or ducts beneath the marker. The letters shall be 4 inches high and 3 inches wide with width of stroke 1/2 inch and 1/4 inch deep or as large as the available space permits.

110-2.10 GROUND ROD INSPECTION PITS USED AS DUCT MARKERS

Ground rod inspection pits may be used as the required cable markers, at ground rod locations, provided the concrete anchor is marked per the cable marker requirements. Markers shall be installed immediately above the cable.

110-2.11 CONDUIT PULLING LUBRICANT

Thomas and Betts, Kopr-Kote or approved equal shall be applied to all steel metallic thread type fittings for underground conduits.

CONSTRUCTION METHODS

110-3.1 GENERAL*. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The Engineer shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications.*

Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches inside diameter ~~or comply with the National Electrical Code based on cable to be installed, whichever is larger~~.

All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system or aggregate pit. Pockets or traps where moisture may accumulate shall be avoided. No duct bank or underground

conduit shall be less than 18 inches below finished grade. Where under pavement, the top of the duct bank shall not be less than 18 inches below the sub grade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4-inch smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

The Contractor shall swab out all conduits/ducts and clean base can, manhole, pull boxes, etc. interiors IMMEDIATELY prior to pulling cable. Once cleaned and swabbed the base cans, manhole, pull boxes, etc. and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc. is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the Engineer of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200 pound test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminate from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet.

Unless otherwise shown on the plans, concrete encased duct banks shall be utilized when crossing under pavements expected to carry aircraft loads.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise

specified, cable trenches shall be excavated to a minimum depth of 21 inches below finished grade, except when off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches unless otherwise specified.

Trenching across existing runway or taxiway pavements shall not be allowed. Conduits crossing existing runways or taxiways shall be installed via jack and bore. Trenching across existing abandoned pavements shall disturb the minimum amount of pavement possible. Depth of existing pavements may vary; contractor is responsible for potholing in order to determine depth of concrete. Saw cut (concrete) or Vermeer wheel (asphalt) for width of trench before excavating.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve. Flowable backfill may alternatively be used The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All such rock removal shall be performed and paid for under Section 23 Earthwork (FAA Item P-152).

Underground electrical warning (caution) tape shall be installed in the trench above all underground duct banks and conduits in unpaved areas. Contractor shall ~~submit a sample of~~ provide a submittal for the proposed warning tape for approval by the Engineer. If not shown on the plans, the warning tape shall be located six inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared in accordance with the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet.

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the Engineer, the unsuitable material shall be removed in accordance with ~~item P-152~~ Section 23 Earthwork and replaced with suitable material. Alternatively, additional duct bank supports that are adequate and stable shall be installed, as approved by the Engineer.

All excavation shall be unclassified and shall be considered incidental to the respective pay item of which it is a component part. Dewatering necessary for

duct installation, erosion and turbidity control, in accordance with Federal, State, and Local requirements is incidental to its respective pay item as a part of the item ~~L-110~~. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the ~~L-110~~ item.

Unless otherwise specified, excavated materials that are deemed by the Engineer to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the Engineer and compacted in accordance with ~~item P-152~~ Section 23 Earthwork.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall insure that these cable(s) are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

***(1)** Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred*

***(2)** Trenching, etc., in cable areas shall then proceed with approval of the Engineer, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.*

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

All ducts, installed under runways, taxiways, aprons, and other paved areas shall be encased in a concrete envelope, extending 5 feet beyond edge of traffic area.

***110-3.2 DUCT BANKS**. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches below finished grade where installed in unpaved areas.*

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet beyond the edges of the pavement or 3 feet beyond any underdrains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, proper provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches thick prior to its initial set. Where two or more conduits in the duct

bank are intended to carry conductors of equivalent voltage insulation rating, the Contractor shall space the conduits not less than ~~1-1/2~~ 7-1/2 inches apart (measured from ~~outside wall to outside wall~~ center of conduit to center of conduit). Where two or more conduits in the duct bank are intended to carry conductors of differing voltage insulation rating, the Contractor shall space the conduits not less than ~~3~~ 12 inches apart (measured from outside ~~wall to outside wall~~ center of conduit to center of conduit). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches thick ~~unless otherwise shown on plans~~. End bells or couplings shall be installed flush with the concrete encasement at access points.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars, where indicated on the plans, shall be driven vertically into the soil a minimum of 6 inches to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5 - foot intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the Engineer for review prior to use.

Where specified on the plans, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5 foot intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly sawcut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 4-6 inch wide tape 8 inches (200mm) minimum below grade above all underground conduit or duct lines not installed under pavement.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the Engineer shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the Engineer.

~~110-3.3 CONDUITS WITHOUT CONCRETE ENCASEMENT.~~ *~~Trenches for single conduit lines shall be not less than 6 inches (150 mm) nor more than 12~~*

~~*inches (300 mm) wide, and the trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.*~~

~~*Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch (6 mm) sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively used.*~~

~~*Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits are at least 18 inches (45 cm) below the finished grade.*~~

~~*When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 2 inches (50 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall spaced not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and lot less than 6 inches (150 mm) apart in a vertical direction.*~~

~~*Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.*~~

~~*Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5 - foot intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the Engineer for review prior to use.*~~

110-3.4 MARKERS. *The location of each end ~~and~~ of ~~each change of direction of conduits and~~ duct banks shall be marked by a concrete slab marker 2 feet (60 cm) square and 4-6 inches (100-150 mm) thick extending approximately 1 inch (25 mm) above the surface. The markers shall ~~also~~ be located directly above the ends of all conduits or duct banks, except where they terminate in a junction/access structure or building.*

The Contractor shall impress the word "DUCT" ~~or "CONDUIT"~~ on each marker slab. The Contractor shall also impress on the slab the number and size of conduits beneath the marker along with all other necessary information as determined by the Engineer. The letters shall be 4 inches (100 mm) high and 3 inches (75 mm) wide with width of stroke 1/2-inch (12 mm) and 1/4-inch (6 mm) deep or as large as the available space permits. Furnishing and installation of duct markers is incidental to the respective duct pay item.

~~110-3.5 BACKFILLING FOR CONDUITS.~~ *~~For conduits, 8 inches (200 cm) of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted in accordance with Item P-152 "Excavation and Embankment" except that material used for back fill shall be select material not larger than 4 inches in diameter.~~*

~~Flowable backfill may alternatively be used~~

~~Trenches shall not contain pools of water during back, filling operations.~~

~~The trench shall be completely backfilled and tamped level with the adjacent surface: except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.~~

~~Any excess excavated material shall be removed and disposed of in accordance with instructions issued by the Engineer.~~

110-3.6 BACKFILLING FOR DUCT BANKS*. After the concrete has cured, the remaining trench shall be backfilled and compacted in accordance with ~~item P-152 "Excavation and Embankment"~~ Section 23 Earthwork, except that the material used for backfill shall be select material not larger than 4 inches in diameter. In addition to the requirements of ~~P-152~~ Section 23, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet of duct bank or one work period's construction, whichever is less.*

Flowable backfill may alternatively be used

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface: except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of in accordance with instructions issued by the Engineer.

***110-3.7 RESTORATION**. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include seeding shown on the plans, and included in the specifications. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. All restoration shall be considered incidental to the respective ~~L-110~~ electrical pay item.*

METHOD OF MEASUREMENT

***110-4.1** See Section 71-2 ~~Underground conduits and duct banks shall be measured by the linear feet (meter) of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated, resolution, and for drain lines, the termination at the drainage structure, all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.~~*

BASIS OF PAYMENT

***110-5.1** See Section 71-3. ~~Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with the provisions and intent of the plans and specifications.~~*

~~*Payment will be made under:*~~

~~*Item L-110-5.1 Electrical Duct Bank, [# and Size] per linear foot (meter)*~~

~~*Item L-110-5,2 Electrical Conduit [# and size] per linear foot (meter)*~~

MATERIAL REQUIREMENTS

Fed.Spec.W-C-1094	*Conduit and Conduit Fittings; Plastic, Rigid (cancelled; replaced by UL 514 Boxes, Nonmetallic Outlet, Flush Device Boxes, &*

Covers, and UL 651 Standard for Conduit & Hope Conduit, Type EB & A Rigid PVC)

~~*Underwriters Laboratories Standard 6 Rigid Metal Conduit*~~

Underwriters Laboratories Standard 514B Fittings for Cable and Conduit

~~*Underwriters Laboratories Standard 651 Schedule 40 and 80 Rigid PVC Conduit (for Direct Burial)*~~

Underwriters Laboratories Standard 651A Type EB and A Rigid PVC Conduit and HDPE Conduit (for concrete encasement)

END OF ITEM L-110

71-2 METHOD OF MEASUREMENT

Duct bank or conduit shall be measured by the number of linear feet of counterpoise wire installed in trenches, duct bank or conduit, including ground rods and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate measurement shall be made for each counterpoise wire, duct bank or conduit installed in trench. The measurement for this item shall not include additional quantities required for back filling trenches.

The cost of all excavation, backfill, dewatering and restoration regardless of the type of material encountered shall be included in the unit price bid for the work.

71-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for trenching, bare counterpoise wire and duct bank or conduit, installed by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Trenching and backfilling will not be measured for payment but will be considered incidental to the associated bid item.

END OF SECTION 71

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. This item shall consist of underground electrical conduits and duct banks

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. All equipment and materials shall be subject to acceptance through manufacturer's certification

2. Manufacturer's certifications shall not relieve the Contractor of responsibility

3. All materials and equipment shall be submitted to the Engineer for approval

4. The data submitted shall be sufficient, to determine compliance with the plans

5. All equipment and materials shall be guaranteed against defects for a period of at least twelve (12) months

B. ~~STEEL CONDUIT~~

1. ~~Rigid galvanized steel conduit and fittings~~

C. PLASTIC CONDUIT

1. Plastic conduit and fittings-shall conform to the requirements of Fed. Spec. W--C-1094.

a) Type I–Schedule 40 PVC

b) Type II–Schedule 40 PVC

Non-metallic conduit and fittings shall conform to the requirements of Fed. Spec. W-C-1094 and shall be Type II, Schedule 40

D. SPLIT CONDUIT

1. Split conduit shall be pre-manufactured

E. CONDUIT SPACERS

1. Conduit spacers shall be prefabricated

F. CONCRETE

1. Concrete encasement with red dye shall conform to Section 54.

G. FLOWABLE BACKFILL

1. Flowable material shall conform to Section 24 of these specifications

H. DETECTABLE WARNING TAPE

1. Red detectable conduit marker tape shall be inert polyethylene plastic

I. DUCT MARKERS

1. The location of duct bank terminations shall be marked by a concrete slab marker 2 ft square

J. GROUND ROD INSPECTION PITS USED AS DUCT MARKERS

1. Ground rod inspection pits may be used as the required cable markers

K. CONDUIT PULLING LUBRICANT

1. Thomas and Betts, Kopr-Kote or approved equal

III. CONSTRUCTION METHODS

A. GENERAL

1. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans

B. DUCT BANKS

1. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches

~~C. CONDUITS WITHOUT CONCRETE ENCASEMENT~~

1. ~~Trenches for single conduit lines~~

D. MARKERS

1. The location of each end of duct banks shall be marked by a concrete slab marker

~~E. BACKFILLING FOR CONDUITS~~

1. ~~For conduits, 8 inches~~

F. BACKFILLING FOR DUCTBANKS

1. After the concrete has cured, the remaining trench shall be backfilled

G. RESTORATION

1. Where sod has been removed, it shall be replaced

IV. METHOD OF MEASUREMENT

1. Duct bank or conduit shall be measured by the number of linear feet

V. BASIS OF PAYMENT

1. Payment will be made at the contract unit price

VI. MATERIAL REQUIREMENTS

A. Fed.Spec.W-C-1094

~~B. Underwriters Laboratories Standard 6~~

C. Underwriters Laboratories Standard 514B

~~D. Underwriters Laboratories Standard 651~~

E. Underwriters Laboratories Standard 651A

END OF SECTION 71

SECTION 72 – ELECTRICAL MANHOLES AND JUNCTION STRUCTURES **(FAA L-115)**

72-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of pull boxes, manholes, and miscellaneous underground structures for airfield electrical systems in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item L-115, as included and modified hereafter, and as shown on the Plans.

It shall also include all trenching, backfilling, removal, and restoration of any paved areas; concrete footings (where required), mandreling installation of pulling irons, cable hooks, ladders, grounding rods and capping, and the testing of the installation as a completed unit ready for installation of cables, to the satisfaction of the Owner and Engineer. The Contractor shall protect the existing pavements from damage by use of any equipment with tracks, stabilization feet, hydraulic fluids, etc., during the construction of this item.

ITEM L-115 ELECTRICAL MANHOLES AND JUNCTION STRUCTURES

DESCRIPTION

115-1.1 *This item shall consist of electrical manholes and junction structures (handholes, pullboxes, junction cans, etc.) installed in accordance with this specification, at the indicated locations and conforming to the lines, grades and dimensions shown on the plans or as required by the Engineer. This item shall include the installation of each electrical manhole and/or junction structures with all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, ladders, appurtenances, testing, dewatering and restoration of surfaces to the satisfaction of the Engineer.*

EQUIPMENT AND MATERIALS

115-2.1 GENERAL.

a. *All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.*

b. *Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed,*

when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

c. *All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.*

d. *The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.*

e. *All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.*

115-2.2 CONCRETE STRUCTURES.

a. *Cast-in-place concrete structures shall conform to the details and dimensions shown on the plans.*

Provide precast concrete structures where shown on the plans. Precast concrete structures shall be an approved standard design of the manufacturer. Precast units shall have mortar or bitumastic sealer placed between all joints to make them watertight. ~~The structure shall be designed to withstand [ZZZ lb aircraft] loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.~~

Threaded inserts and pulling eyes shall be cast in as shown.

If the Contractor chooses to propose a different structural design, signed and sealed shop drawings, design calculations, and other information requested by

the Engineer shall be submitted by the Contractor to allow for a full evaluation by the Engineer. The Engineer shall review in accordance with the process defined in the General Provisions.

Handholes and electrical vaults shall be aircraft load rated for a minimum of 100,000 lbs wheel loading, suitable for use adjacent to airfield taxiways and runways in accordance with the loading requirements in paragraph 115-2.2.1. Precast concrete handholes and electrical vaults, covers, tops, and related assemblies shall conform to ASTM C 478. Concrete for handholes and electrical vaults shall be 4500 psi. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete handholes and electrical vaults. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Covers shall fit frames without undue play. Steel and iron shall be formed to shape with sharp lines and angles. Castings shall be free from warp and blow holes that may impair their strength or appearance. Exposed metal shall have a smooth finish and sharp lines. Provide all necessary lugs and brackets. Door cover section shall be provided with pre-manufactured or welded grounding strap lug, braided electrical grounding strap, tie-down bolts, two recessed pullout lift handles, removable load beams, locking torsion hinges, and appropriately engraved/inscribed identification on top of cover for the intended application. The word "POWER" or "COMM" shall be cast in the top face of all covers. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable. Cable racks, rack arms, and support brackets shall be fiberglass, PVC, or nylon, and shall be rated for 350-pound load, minimum. Support hardware such as screws, nuts, bolts, and anchors shall be 316 Stainless Steel with field applied PVC coating. Handholes and electrical vaults shall have a sump, ground rod knockouts, raceway knockouts, and cast in place galvanized channels for securing cable racks.

b. *All handholes and electrical vaults shall be provided with a saddle rack on each vertical wall surface where cables are routed. Saddle racks shall be the three-saddle type with 3" saddle throat opening and slip-on lock assembly. Saddle racks shall be constructed of high performance polymer with UV stabilization. Saddle racks shall be constructed of super tough yellow nylon with UV stabilization. Mounting shall be per manufacturer's requirements for "permanent installation". Saddle racks shall be manufactured by Underground Devices Inc., or approved equal.*

115-2.2.1 LOADING.

The Contractor shall provide stamped, engineering calculations showing that the surfacing method proposed will withstand aircraft loading not less than 100,000 lbs wheel loading in conformance with the requirements set forth in the Appendices to FAA Advisory Circular 150-5320-6, Pavement Design.

115-2.3 JUNCTION CANS. Junction Cans shall be L-867 Class 1 (non-load bearing for edge lights, signs and other in-field installations) or L-868 Class 1 (load bearing for centerline fixtures and other in pavement installations) cans encased in concrete. The cans shall have a galvanized steel blank cover, gasket, and stainless steel hardware, when no fixture is installed. Covers shall be 3/8" thickness for L-867 and 3/4" thickness for L-868. L-867 and L-868 unless otherwise noted shall be 24 inches deep.

115-2.4 MORTAR. *The mortar shall be composed of one part of portland cement and two parts of mortar sand, by volume. The portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15 percent of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C 6. The water shall be clean and free of deleterious amounts of acid, alkalies or organic material. If the water is of questionable quality, it shall be tested in accordance with AASHTO T-26.*

115-2.5 CONCRETE. *All concrete used in structures shall conform to the requirements of Section 54 (FAA Item P-610, Structural Portland Cement Concrete).*

115-2.6 FRAMES AND COVERS. *The frames shall conform to one of the following requirements:*

~~***a.*** *Gray iron castings shall meet the requirements of ASTM A 48.*~~

~~***b.*** *Malleable iron castings shall meet the requirements of ASTM A 47.*~~

c. *Steel castings shall meet the requirements of ASTM A 27.*

d. *Structural steel for frames shall conform to the requirements of ASTM A-283, Grade D.*

e. *Ductile iron castings shall conform to the requirements of ASTM A 536.*

f. *Austempered ductile iron castings shall conform to the requirements of ASTM A 897.*

All castings specified shall withstand the loadings described in paragraph 115-2.2.1.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover unit shall be provided with fastening members to prevent it from being dislodged by traffic, but which will allow easy removal for access to the structure.

Each pull box frame and cover shall be equipped with spring loaded assisted lifting devices(capable of lifting the cover to within 30% of the total lid weight) and support rods to prevent accidental closures.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A 123.

Each cover shall have the word "ELECTRIC" or "COMM" and the associated pull box or manhole designation number cast on it. No cable notches are required.

115-2.7 LADDERS. *Ladders, installed in all manholes deeper than 5'-0" and where specified, shall be galvanized steel or as shown on the plans, and extend the full length of the manhole including neck, to within 6" of the finish grade.*

115-2.8 REINFORCING STEEL. *All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A 615, Grade 60.*

115-2.9 BEDDING/SPECIAL BACKFILL. *Bedding or special backfill shall be as shown on the plans.*

115-2.10 FLOWABLE BACKFILL. *Flowable material used to backfill shall conform to the requirements of Item P-153 "Controlled Low Strength Material".*

115-2.11 CABLE TRAYS. *Cable trays shall be of galvanized steel, or plastic~~, or aluminum~~. Cable trays shall be located as shown on the plans.*

115-2.12 PLASTIC CONDUIT. *Plastic conduit shall comply with Specification Section 71 (FAA Item L-110 - Airport Underground Electrical Duct Banks and Conduits).*

115-2.13 CONDUIT TERMINATORS. *Conduit terminators shall be bell shaped, pre-manufactured for the specific purpose and sized as required or as shown on the plans.*

115-2.14 PULLING-IN IRONS. *Pulling-in irons shall be manufactured with 7/8-inch diameter hot-dipped galvanized steel or stress-relieved carbon steel roping designed for concrete applications (7 strand, 1/2-inch diameter with an ultimate strength of 270,000 psi). Where stress-relieved carbon steel roping is*

used, a rustproof sleeve shall be installed at the hooking point and all exposed surfaces shall be encapsulated with a polyester coating to prevent corrosion.

115-2.15 GROUND RODS. *Ground rods shall be one piece, copper. The ground rods shall be 10-feet long and no less than 5/8 inch (15 mm) in diameter.*

CONSTRUCTION METHODS

115-3.1 UNCLASSIFIED EXCAVATION. *It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Damage to utility lines, through lack of care in excavating, shall be repaired or replaced to the satisfaction of the Engineer without additional expense to the Owner.*

The Contractor shall perform excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.

All excavation shall be unclassified and shall be considered incidental to the respective L-115 pay item of which it is a component part. Dewatering necessary for L-115 structure installation, erosion and turbidity control, in accordance with Federal, State, and Local requirements is incidental to its respective pay item as a part of Item L-115. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-115 Item.

Boulders, logs and all other objectionable material encountered in excavation shall be removed. All rock and other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the Engineer. All seams, crevices, disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

The Contractor shall provide all bracing, sheeting and shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheeting and shoring shall be included in the unit price bid for the structure.

Unless otherwise provided, bracing, sheeting and shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

After each excavation is completed, the Contractor shall notify the Engineer. Structures shall be placed after the Engineer has approved the depth of the excavation and the suitability of the foundation material.

Prior to installation the Contractor shall provide a minimum of 6 inches of sand or a material approved by the Engineer as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

115-3.2 CONCRETE STRUCTURES. *Concrete structures shall be built on prepared foundations conforming to the dimensions and form indicated on the plans. The concrete and construction methods shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is placed.*

115-3.3 PRECAST UNIT INSTALLATIONS. *Precast units shall be installed plumb and true. Joints shall be made watertight by use of sealant at each tongue-and-groove joint and at roof of manhole. Excess sealant shall be removed and severe surface projections on exterior of neck shall be removed.*

115-3.4 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES AND FITTINGS. *All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the Engineer and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.*

Field connections shall be made with bolts, unless indicated otherwise. Welding will not be permitted unless shown otherwise on the approved shop drawings and written permission is granted by the casting manufacturer. Erection equipment shall be suitable and safe for the workman. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to the Engineer and approval of the method of correction shall be obtained. Approved corrections shall be made at Contractor's expense.

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

Pulling-in irons shall be located opposite all conduit entrances into structures to provide a strong, convenient attachment for pulling-in blocks when installing

cables. Pulling-in irons shall be set directly into the concrete walls of the structure.

115-3.5 INSTALLATION OF LADDERS. *Ladders shall be installed such that they may be removed if necessary. Mounting brackets shall be supplied top and bottom and shall be cast in place during fabrication of the structure or drilled and grouted in place after erection of the structure.*

115-3.6 REMOVAL OF SHEETING AND BRACING. *In general, all sheeting and bracing used to support the sides of trenches or other open excavations shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a structure shall be withdrawn, unless otherwise directed, before more than six (6) inches of material is placed above the top of the structure and before any bracing is removed. Voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.*

The Engineer may order the Contractor to delay the removal of sheeting and bracing if, in his judgment, the installed work has not attained the necessary strength to permit placing of backfill.

115-3.7 BACKFILLING. *After a structure has been completed, the area around it shall be backfilled in horizontal layers not to exceed 6 inches in thickness measured after compaction to the density requirements in ~~Item P-152~~ Section 23 Earthwork. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the Engineer.*

Backfill shall not be placed against any structure until permission is given by the Engineer. In the case of concrete, such permission shall not be given until tests made by the laboratory under supervision of the Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

Where required, the Engineer may direct the Contractor to add, at his own expense, sufficient water during compaction to assure a complete consolidation of the backfill. The Contractor shall be responsible for all damage or injury done to conduits, duct banks, structures, property or persons due to improper placing or compacting of backfill.

115-3.8 CONNECTION OF DUCT BANKS. *To relieve stress of joint between concrete-encased duct banks and structure walls, reinforcement rods*

shall be placed in the structure wall and shall be formed and tied into duct bank reinforcement at the time the duct bank is installed.

115-3.9 GROUNDING. *A ground rod shall be installed in the floor of all concrete structures so that the top of rod extends 6 inches above the floor. The ground rod shall be installed within 1 foot of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab, or a ¾" sleeve provided in prefabricated manholes or pull boxes. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor shall drill a 4-inch diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod.*

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of 1 foot above the floor of the structure and separate from other cables. No. 2 AWG bare copper pigtails shall bond the grounding bus to all cable trays and other metal hardware within the concrete structure. Connections to the grounding bus shall be exothermic. Hardware connections may be mechanical, using a lug designed for that purpose.

115-3.10 CLEANUP AND REPAIR. *After erection of all galvanized items, damaged areas shall be repaired by applying a liquid cold-galvanizing compound conforming MIL-P-21035. Surfaces shall be prepared and compound applied in accordance with manufacturer's recommendations.*

Prior to acceptance, the entire structure shall be cleaned of all dirt and debris.

115-3.11 RESTORATION. *After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. The Contractor shall restore all disturbed areas equivalent to or better than their original condition. All sodding, grading and restoration shall be considered incidental to the respective L-115 pay item.*

The Contractor shall grade around structures as required to provide positive drainage away from the structure.

Areas with special surface treatment, such as roads, sidewalks, or other paved areas shall have backfill compacted to match surrounding areas, and surfaces shall be repaired using materials comparable to original materials.

After all work is completed, the Contractor shall remove all tools and other equipment, leaving the entire site free, clear and in good condition.

115-3.12 INSPECTION. *Prior to final approval, the electrical structures shall be thoroughly inspected for conformance with the plans and this specification. Any indication of defects in materials or workmanship shall be further investigated and corrected. The earth resistance to ground of each ground rod shall not exceed 25 ohms. Each ground rod shall be tested utilizing the fall-of-potential ground impedance test as described by ANSI IEEE Standard 81. This test shall be performed prior to establishing connections to other ground electrodes.*

115-3.13 MANHOLE ELEVATION ADJUSTMENTS. *The Contractor shall adjust the tops of existing manholes in areas designated in the Contract Documents to the new elevations shown. The Contractor shall be responsible for determining the exact height adjustment required to raise the top of each manhole to the new elevations. The existing top elevation of each manhole to be adjusted shall be determined in the field and subtracted/added from the proposed top elevation.*

The Contractor shall remove/extend the existing top section or ring and cover on the manhole structure or manhole access. The Contractor shall then install precast concrete sections or grade rings of the required dimensions to adjust the manhole top to the new proposed elevation or shall cut the existing manhole walls to shorten the existing structure, as required by final grades. Finally, the Contractor shall reinstall the manhole top section or ring and cover on top and check the new top elevation.

The Contractor shall construct a concrete slab around the top of adjusted structures located in graded areas that are not to be paved. The concrete slab shall conform to the dimensions shown on the plans.

115-3.14 Duct Extension to Existing Ducts. *Where existing concrete encased ducts are to be extended, the duct extension shall be concrete encased plastic conduit. The fittings to connect the ducts together shall be standard manufactured connectors designed and approved for the purpose. The duct extensions shall be installed according to the concrete encased duct detail and as shown on the plans.*

METHOD OF MEASUREMENT

115-4.1 *See Section 71-2.* ~~*Electrical manholes and junction structures shall be measured by each unit completed in place and accepted. The following additional items are specifically included in each unit.*~~

~~*All Required Excavation, Dewatering*~~

~~*Sheeting and Bracing*~~

~~*All Required Backfilling with On-Site Materials*~~

~~*Restoration of All Surfaces and Finished Grading, Sodding*~~

~~*All Required Connections*~~

~~*Dewatering If Required*~~

~~*Temporary Cables and Connections*~~

~~*Ground Rod Testing*~~

~~***115-4.2** Manhole elevation adjustments shall be measured by the completed unit installed, in place, completed, and accepted. Separate measurement shall not be made for the various types and sizes.~~

BASIS OF PAYMENT

115-5.1 *See Section 71-3. ~~The accepted quantity of electrical manholes and junction structures will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.~~*

~~115-5.2~~ *~~Payment shall be made at the contract unit price for manhole elevation adjustments. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary, including but not limited to, spacers, concrete, rebar, dewatering, excavating, backfill, topsoil, sodding and pavement restoration, where required, to complete this item as shown in the plans and to the satisfaction of the Engineer.~~*

~~Payment will be made under:~~

~~Item L-115-5.1 Electrical Manhole [size and type] -Per Each~~

~~Item L-115-5.2 Electrical Junction Structure [size and type] -Per Each~~

~~Item L-115-5.3 Existing Electrical Manhole/Junction Structure Elevation Adjustment [size and type] - Per Each~~

MATERIAL REQUIREMENTS

ANSI/IEEE Std 81	*IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System*
AC 150/5345-7	*Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits*
AC 150/5345-26	*Specification for L-823 Plug and Receptacle Cable Connectors*
FED SPEC J-C-30	*Cable and Wire, Electrical Power, Fixed Installation (cancelled; replaced by AA-59544 Cable and Wire, Electrical (Power, Fixed Installation))*

ASTM B.3	*Soft or Annealed Copper Wire*
ASTM B.8	*Concentric-Lay-Stranded Copper Conductor, Hard, Medium-Hard, or Soft*

END OF ITEM L-115

71-2 METHOD OF MEASUREMENT

Manhole and pull box structures shall be measured by the completed unit installed, in place, completed, and accepted. Separate measurement shall not be made for ground rods, ladders, pulling irons, conduit terminators and cable trays or hooks.

Electrical manholes and junction structures shall be measured by each unit completed in place and accepted. The following additional items are specifically included in each unit.

- All Required Excavation, Dewatering
- Sheeting and Bracing
- All Required Backfilling with On-Site Materials
- Restoration of All Surfaces and Finished Grading, Sodding
- All Required Connections
- Dewatering If Required
- Temporary Cables and Connections
- Ground Rod Testing

71-3 BASIS OF PAYMENT

Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with the provisions and intent of the plans and specifications.

The accepted quantity of electrical manholes and pull boxes will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

Payment shall be made at the contract unit price for manhole and pull box elevation adjustments. This price shall be full compensation for furnishing all materials and for all preparation,

assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary, including but not limited to, spacers, concrete, rebar, dewatering, excavating, backfill, topsoil, sodding and pavement restoration, where required, to complete this item as shown in the plans and to the satisfaction of the Engineer.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

END OF SECTION 72

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. This item shall consist of electrical manholes and junction structures (handholes, pullboxes, junction cans, etc.)

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. All equipment and materials shall be subject to acceptance through manufacturer's certification

2. Manufacturer's certifications shall not relieve the Contractor of responsibility

3. All materials and equipment shall be submitted to the Engineer for approval

4. The data submitted shall be sufficient, to determine compliance with the plans

5. All equipment and materials shall be guaranteed against defects for a period of at least twelve (12) months

B. CONCRETE STRUCTURES

1. Cast-in-place concrete structures shall conform to the details and dimensions shown on the plans

2. All handholes and electrical vaults shall be provided with a saddle rack on each vertical wall

3. LOADING

a) The Contractor shall provide stamped, engineering calculations showing 100,000 lbs wheel loading

C. JUNCTION CANS

1. Junction Cans shall be L-867 Class 1 or L-868 Class 1

D. MORTAR

1. The mortar shall be composed of one part portland cement and two parts mortar sand

E. CONCRETE

1. All concrete shall conform to Section 54

F. FRAMES AND COVERS

1. The frames shall conform to:

~~a) ASTM A 48~~

~~b) ASTM A 47.~~

c) ASTM A 27.

d) ASTM A-283, Grade D

e) ASTM A 536.

f) ASTM A 897.

Each pull box frame and cover shall be equipped with spring loaded assisted lifting devices

G. LADDERS

1. Ladders, installed in all manholes deeper than 5’-0”

H. REINFORCING STEEL

1. All reinforcing steel shall be deformed bars

I. BEDDING/SPECIAL BACKFILL

1. As shown on the plans

J. FLOWABLE BACKFILL

1. Shall conform to the requirements of Item P-153

K. CABLE TRAYS

1. Shall be of galvanized steel, or plastic

L. PLASTIC CONDUIT

1. Shall comply with Specification Section 71

M. CONDUIT TERMINATORS

1. Shall be bell shaped

N. PULLING-IN IRONS

1. Shall be manufactured with 7/8-inch diameter steel

O. GROUND RODS

1. Ground rods shall be one piece, copper

III. CONSTRUCTION METHODS

A. UNCLASSIFIED EXCAVATION

1. It is the Contractor's responsibility to locate existing utilities

B. CONCRETE STRUCTURES

1. Concrete structures shall be built on prepared foundations

C. PRECAST UNIT INSTALLATIONS

1. Precast units shall be installed plumb and true

D. PLACEMENT AND TREATMENT OF CASTINGS, FRAMES AND FITTINGS

1. All castings, frames and fittings shall be placed in the positions indicated

E. INSTALLATION OF LADDERS

1. Ladders shall be installed such that they may be removed if necessary

F. REMOVAL OF SHEETING AND BRACING

1. All sheeting and bracing shall be withdrawn

G. BACKFILLING

1. After a structure has been completed, the area around it shall be backfilled

H. CONNECTION OF DUCT BANKS

1. Reinforcement rods shall be placed in the structure wall

I. GROUNDING

1. A ground rod shall be installed in the floor of all concrete structures

J. CLEANUP AND REPAIR

1. Damaged areas shall be repaired

K. RESTORATION

1. The Contractor shall dispose of all surplus material

L. INSPECTION

1. Prior to final approval, the electrical structures shall be thoroughly inspected

M. MANHOLE ELEVATION ADJUSTMENTS

1. The Contractor shall adjust the tops of existing manholes in areas designated

2. Duct extension to existing ducts

IV. METHOD OF MEASUREMENT

1. Manhole and pull box structures shall be measured by the completed unit installed, in place

V. BASIS OF PAYMENT

1. Payment will be made at the contract unit price

VI. MATERIAL REQUIREMENTS

1. ANSI/IEEE Std 81

2. AC 150/5345-7

3. AC 150/5345-26

4. FED SPEC J-C-30

5. ASTM B.3

6. ASTM B.8

END OF SECTION 72

SECTION 73 – AIRPORT 12-FOOT WIND CONES **(FAA L-107*)***

73-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of wind cones in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item L-107, as included and modified hereafter, and as shown on the Plans.

It shall also include all trenching, backfilling, removal, and restoration of any paved areas; handholes, concrete foundations (where required), and the testing of the installation as a completed lighted wind cone ready for activation, to the satisfaction of the Owner and Engineer. The Contractor shall protect the existing pavements from damage by use of any equipment with tracks, stabilization feet, hydraulic fluids, etc., during the construction of this item.

ITEM L-107 AIRPORT 8-FOOT AND 12-FOOT WIND CONES

DESCRIPTION

107-1.1 *This item shall consist of furnishing and installing an airport wind cone in accordance with these specifications and in accordance with the dimensions, design, and details shown in the plans.*

The work shall include the furnishing and installation of a support for mounting the wind cone, the specified wire, and a concrete foundation. The item shall also include all cable connections, conduit and conduit fittings, the furnishing and installation of all lamps, ground rod and ground connection, the testing of the installation, and all incidentals necessary to place the wind cone in operation as a completed unit to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

107-2.1 GENERAL.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified and listed under Advisory Circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these

specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

107-2.2 WIND CONES. *The ~~8-foot and~~ 12-foot (3.5 m) wind cone and assembly shall conform to the requirements of AC 150/5345-27, Specification for Wind Cone Assemblies.*

The illuminated wind cone must present a constant brightness to the pilot. As a result, the source of power for the wind cone circuit must be identified. The wind cone shall be powered from a nearby series lighting circuit as a power source to the wind cone, a power adapter that converts constant current to constant voltage must be specified. An additional requirement for the power adapter is the output voltage must remain constant regardless of the input current. The manufacturer of the power adapter must be consulted to verify the additional load imposed on the series circuit by the power adapter.

107-2.3 WIRE. *Wire in conduit rated up to 5,000 volts shall conform to AC 150/5345-7, Specification Section 69 for L-824 Underground Cable for Airport Lighting Circuits for Rubber Insulated Neoprene Covered Wire, or Fed. Spec. J-C-30, Type RHW, for rubber insulated fibrous covered wire. For ratings up to 600 volts, thermoplastic wire conforming to Fed. Spec. J-C-30, Types TW, THW, and THWN, shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.*

107-2.4 CONDUIT. *Above ground conduit shall be rigid steel conduit. Both conduit and fittings shall conform to the requirements of Underwriters Laboratories Standard 6, 514, and 1242.*

107-2.5 PLASTIC CONDUIT (for use below grade only). *Plastic conduit and fittings-shall conform to the requirements of Fed. Spec. W--C-1094 and Underwriters Laboratories Standards UL-651 and shall be one of the following, as shown in the plans:*

a. Type I–Schedule 40 PVC suitable for underground use either direct-buried or encased in concrete.
b. Type II–Schedule 40 PVC suitable for either above ground or underground use.

Plastic conduit adhesive shall be a solvent cement manufactured specifically for the purpose of gluing the specific type of plastic conduit and fitting.

107-2.6 CONCRETE. *The concrete for foundations shall be proportioned, placed, and cured in accordance with Item P-610, Structural Portland Cement Concrete.*

107-2.7 PAINT.

a. *Priming paint for ungalvanized metal surfaces shall be a high solids alkyd primer conforming to TT-P-664D.*

b. Priming paint for galvanized metal surfaces shall be zinc dust-zinc oxide primer paint conforming to MIL-DTL-24441/19B. If necessary, add not more than ½ pint (0.06 liter) of turpentine to each gallon (liter).

c. Orange paint for the body and the finish coats on metal and wood surfaces shall consist of a ready-mixed non-fading paint meeting the requirements of Fed. Spec. TT-E-489. The color shall be in accordance with Federal Standards 595, Aviation Gloss Orange Number 12197.

d. White paint for body and finish coats on metal ~~and wood~~ surfaces shall be ready-mixed paint conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2.

~~*e. Priming paint for wood surfaces shall be mixed on the job by thinning the above specified aviation-orange or white paint by adding ½ pint (0.06 liter) of raw linseed oil to each gallon (liter).*~~

CONSTRUCTION METHODS

107-3.1 INSTALLATION. *The hinged support or hinged pole shall be installed on a concrete foundation as shown in the plans.*

107-3.2 POLE ERECTION. *The Contractor shall erect the pole on the foundation following the manufacturer's requirements and erection details. The pole shall be level and secure.*

107-3.3 ELECTRICAL CONNECTION. *The Contractor shall furnish all labor and materials and shall make complete electrical connections in accordance with the wiring diagram furnished with the project plans. The electrical installation shall conform to the requirements of the latest edition of National Fire Protection Association, NFPA-70, National Electric Code.*

~~*If underground,*~~ *Cable from the transformer vault to the wind cone site and duct for this cable installation shall be installed in accordance with and paid for as described in Specification Sections 69 and 71 (FAA Item L-108, Underground Power Cables for Airports, and Item L-110, Airport Underground Electrical Duct Banks and Conduits).*

~~***107-3.4 BOOSTER TRANSFORMER.*** *If shown in plans or specified in job specifications, a booster transformer to compensate for voltage drop to the lamps shall be installed in a suitable weatherproof housing. The booster transformer shall be installed as indicated in the plans and described in the proposal. If the booster transformer is required for installation remotely from the windcone, it shall be installed in accordance with and paid for~~

107-3.5 GROUND CONNECTION AND GROUND ROD. *The Contractor shall furnish and install a ground rod, grounding cable, and ground clamps for grounding the support frame of the 12-foot (3.5 m) ~~or pipe support of the 8-foot (240 cm) support~~ assembly near the base. The ground rod shall be of the type, diameter and length specified in Specification Section 69 (FAA Item L-108, Underground Power Cable for Airports). The ground rod shall be driven into the ground adjacent to the concrete foundation (minimum distance from foundation of 2 feet) so that the top is at least 6 inches (150 mm) below grade. The grounding cable shall consist of No. 4 AWG minima bare stranded copper wire or larger and shall be firmly attached to the ground rod by exothermic welding. The other end of the grounding cable shall be securely attached to a leg of the frame or to the base of the pipe support with non-corrosive metal and shall be of substantial construction. The resistance to ground shall not exceed 25 ohms.*

107-3.6 PAINTING. *Three coats of paint shall be applied (one prime, one body, and one finish) to all exposed material installed under this item except the fabric cone, obstruction light globe, and lamp reflectors. The wind cone assembly, if painted on receipt, shall be given one finish coat of paint in lieu of the three coats specified above. The paint shall meet the requirements of Fed. Spec. TT-E-489. The color shall be in accordance with Federal Standard 595, Aviation Gloss Orange Number 12197.*

107-3.7 LAMPS. *The Contractor shall furnish and install lamps as specified by the manufacturer.*

107-3.8 CHAIN ~~AND PADLOCK~~. *The Contractor shall furnish and install a suitable operating chain for lowering and raising the hinged top section. The chain shall be attached to the pole support in a manner to prevent the light fixture assembly from striking the ground in the lowered position.*

~~A padlock shall also be furnished by the Contractor on the 8-foot (240 cm) wind cone for securing the hinged top section to the fixed lower section. Keys for the padlock shall be delivered to the Engineer.~~

~~METHOD OF MEASUREMENT~~

~~107-4.1~~ *~~The quantity to be paid for shall be the number of wind cones installed as completed units in place, accepted, and ready for operation.~~*

~~BASIS OF PAYMENT~~

~~107-5.1~~ *~~Payment will be made at the contract unit price for each completed and accepted job. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.~~*

~~Payment will be made under:~~

~~Item L-107-5.1 12-Foot (3.5 m) Wind Cone, in place per unit~~

~~Item L-107-5.2 8-Foot (240 cm) Wind Cone, in place per unit~~

MATERIAL REQUIREMENTS

AC 150/5345-7 Specification for L-824 Underground Cable for Airport Lighting Circuits

AC 150/5345-27 Specification for Wind Cone Assemblies

FED SPEC TT-E-489 Enamel, Alkyd, Gloss, Low VOC Content

FED SPEC J-C-30 Cable and Wire, Electrical (Power, Fixed Installation) (cancelled; replaced by AA-59544 Cable and Wire, Electrical (Power, Fixed Installation))

FED SPEC W-P-115 Panel, Power Distribution

FED STD 595 Colors Used in Government Procurement

MIL-DTL-24441/20 Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III

Underwriters Laboratories Standard 6 Rigid Metal Conduit

Underwriters Laboratories Standard 514 Fittings For Conduit and Outlet Boxes

Underwriters Laboratories Standard 1242 Intermediate Metal Conduit

NFPA-70 National Electric Code

Master Painter's Institute

END OF ITEM L-107

73-2 METHOD OF MEASUREMENT

Wind cones shall be measured by the number if wind cones installed as complete units in place, accepted by the engineer and ready for operation.

Other underground structures shall be included in the unit price bid for the work.

73-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for each completed and accepted wind cone installed by the contractor. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with the provisions and intent of the plans and specifications.

The accepted quantity of wind cones will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

Item 73.1 12-Foot Wind Cone..... per each

END OF SECTION 73

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. This item shall consist of furnishing and installing an airport wind cone

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. Airport lighting equipment and materials shall be certified and listed

2. All equipment and materials shall be subject to acceptance through manufacturer's certification

3. Manufacturer's certifications shall not relieve the Contractor of responsibility

4. All materials and equipment shall be submitted to the Engineer for approval

5. The data submitted shall be sufficient, to determine compliance with the plans

6. All equipment and materials shall be guaranteed against defects for a period of at least twelve (12) months

B. WIND CONES

1. The ~~8-foot and~~ 12-foot (3.5 m) wind cone

C. WIRE

1. Wire in conduit rated up to 5,000 volts shall conform to AC 150/5345-7, Section 69

D. CONDUIT

1. Above ground conduit shall be rigid steel conduit

E. PLASTIC CONDUIT

1. For below grade only

a) Type I – Schedule 40 PVC

b) Type II – Schedule 40 PVC

F. CONCRETE

1. in accordance with Item P-610

G. PAINT

1. Priming paint for ungalvanized metal surfaces

2. Priming paint for galvanized metal surfaces

3. Orange paint for the body and the finish coats

4. White paint for body and finish coats

5. ~~Priming paint for wood surfaces~~

III. CONSTRUCTION METHODS

A. INSTALLATION

1. Installed on a concrete foundation

B. POLE ERECTION

1. The Contractor shall erect the pole per manufacturer

C. ELECTRICAL CONNECTION

1. Make complete electrical connections in accordance with the project plans

~~D. BOOSTER TRANSFORMER~~

E. GROUND CONNECTION AND GROUND ROD

1. Three coats of paint shall be applied

F. PAINTING

1. All sheeting and bracing shall be withdrawn

G. LAMPS

1. Lamps as specified by the manufacturer

H. CHAIN ~~AND PADLOCK~~

1. Contractor shall furnish and install a suitable operating chain

IV. METHOD OF MEASUREMENT

2. Wind cones shall be measured by the number if wind cones installed

V. BASIS OF PAYMENT

1. Payment will be made at the contract unit price

VI. MATERIAL REQUIREMENTS

1. AC 150/5345-7
2. AC 150/5345-27
3. FED SPEC TT-E-489
4. FED SPEC J-C-30
5. FED SPEC W-P-115
6. FED STD 595
7. MIL-DTL-24441/20
8. Underwriters Laboratories standard 6
9. Underwriters Laboratories standard 514
10. Underwriters Laboratories standard 1242
11. NFPA-70
12. Master Painter's Institute

END OF SECTION 73

SECTION 74 – AIRPORT OBSTRUCTION LIGHTS **(FAA L-119)**

74-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of obstruction lights in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item L-119, as included and modified hereafter, and as shown on the Plans.

It shall also include all mandreling, installation of pulling rope, conduit fittings, capping, and the testing of the installation as a completed, operational system, to the satisfaction of the Owner and Engineer. The Contractor shall protect the existing pavement and utilities from damage by use of any equipment with tracks, stabilization feet, hydraulic fluids, etc., during the construction of this item.

ITEM L-119 AIRPORT OBSTRUCTION LIGHTS

DESCRIPTION

119-1.1 This item shall consist of furnishing and installing obstruction lights in accordance with these specifications. Included in this item shall be the furnishing and installing of stainless steel pipes, or other supports as required in the plans or specifications.

This item shall also include all wire and cable connections, the furnishing and installing of all necessary conduits and fittings, insulators, pole steps, pole cross arms, and the painting of poles and pipes. In addition, it includes the furnishing and installing of all lamps and, if required, the furnishing and installing of insulating transformers, the servicing and testing of the installation and all incidentals necessary to place the lights in operation as completed units to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

119-2.1 GENERAL.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified and listed under Advisory Circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program.

b. All other equipment and materials covered by other reference specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the Contractor’s responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound ~~in a properly sized 3-ring binder, tabbed by specification section~~. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

119-2.2 OBSTRUCTION LIGHTS. The obstruction lights shall conform to the requirements of AC 150/5345-43, Specification for Obstruction Lighting Equipment.

119-2.3 ISOLATION TRANSFORMERS. Where required for series circuits, the isolation transformers shall conform to the requirements of AC 150/5345-47, Isolation Transformers for Airport Lighting Systems.

119-2.4 TRANSFORMER HOUSING. Transformer housings, if specified, shall conform to AC 150/5345-42, Specification for Airport Light Base and Transformer Housings, Junction Boxes, and Accessories.

119-2.5 CONDUIT. For use above ground, rigid steel conduit and fittings shall be in accordance with Underwriters Laboratories Standard 6, 514, and 1242.

119-2.6 PLASTIC CONDUIT (for use below grade only). Plastic conduit and fittings-shall conform to the requirements of Fed. Spec. W--C-1094 and Underwriters Laboratories Standards UL-651 and shall be one of the following, as shown on the plans:

a. Type I–Schedule 40 PVC suitable for underground use either direct-buried or encased in concrete.
b. Type II–Schedule 40 PVC suitable for either above ground or underground use.

119-2.7 WIRES. Wires in conduit rated up to 5,000 volts shall conform to AC 150/5345 7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits, for rubber insulated neoprene covered wire, or Fed. Spec. J-C-30, Type RHW, for rubber insulated fibrous covered wire. For ratings up to 600 volts, thermoplastic wire conforming to Fed. Spec. J-C-30, Types TW, THW, and THWN-2, shall be used. The wires shall be of the type, size, number of

conductors, and voltage shown in the plans or in the proposal. Overhead line wire from pole to pole, where specified, shall conform to ANSI/ICEA S-70-547-1992.

119-2.8 MISCELLANEOUS. Paint, poles, pole steps, insulators, and all other miscellaneous materials necessary for the completion of this item shall be new and first-grade commercial products. These products shall be as specified in the plans or specifications.

CONSTRUCTION METHODS

119-3.1 PLACING THE OBSTRUCTION LIGHTS. The Contractor shall furnish and install single-or double-obstruction lights as specified in the proposal and shown in the plans. The obstruction lights shall be mounted on poles, buildings, or towers approximately at the location shown in the plans. The exact location shall be as directed by the Engineer.

119-3.2 INSTALLATION ON POLES. Where obstruction lights are to be mounted on poles, each obstruction light shall be installed with its hub at least as high as the top of the pole. All wiring shall be run in not less than 1-inch galvanized rigid steel conduit. If specified, pole steps shall be furnished and installed, the lowest step being 5 feet above ground level. Steps shall be installed alternately on diametrically opposite sides of the pole to give a rise of 18 inches for each step. Conduit shall be fastened to the pole with galvanized steel pipe straps and shall be secured by galvanized lag screws. Poles shall be painted as shown in the plans and specifications.

When obstruction lights are installed on existing telephone or power poles, a large fiber insulating sleeve of adequate diameter and not less than 4-feet long, shall be installed to extend 6 inches above the conductors on the upper cross arm. In addition, the sleeve shall be at least 18 inches below the conductors on the lower cross arm. The details of this installation shall be in accordance with the plans.

119-3.3 INSTALLATION ON BEACON TOWER. Where obstruction lights are installed on a beacon tower, two obstruction lights shall be mounted on top of the beacon tower using 1-inch conduit. The conduit shall screw directly into the obstruction light fixtures and shall support them at a height of not less than 4 inches above the top of the rotating beacon. If obstruction lights are specified at lower levels, the Contractor shall install not less than 1-inch galvanized rigid steel conduit with standard conduit fittings for mounting the fixtures. The fixtures shall be mounted in an upright position in all cases. The conduit shall be fastened to the tower members with "wraplock" straps, clamps, or approved fasteners spaced approximately 5 feet apart. Three coats of aviation-orange paint shall be applied (one prime, one body, and one finish coat) to all exposed material installed.

119 3.4 INSTALLATION ON BUILDINGS, TOWERS, SMOKESTACKS, ETC. Where obstruction lights are to be installed on buildings or similar structures, the installation shall be made in accordance with details shown in the plans. The hub of the obstruction light shall be not less than 1 foot above the highest point of the obstruction except in the case of cooling towers where the uppermost units shall be mounted not less than 5 feet nor more than 10 feet below the top of the stack. Conduit supporting the obstruction light units shall be fastened to wooden structures with galvanized steel pipe straps and shall be secured by 1-½ inch No. 10 galvanized wood screws. Conduit shall be fastened to masonry structures by the use of expansion shields, screw anchors, or toggle bolts using No. 10, or larger, galvanized wood or machine screws. Conduit fastened to structural steel shall have the straps held with not less than No. 10 roundhead machine screws in drilled and tapped holes. Fastenings shall be approximately 5 feet apart.

Three coats of aviation-orange paint shall be applied (one prime, one body, and one finish coat) to all exposed material installed.

119-3.5 SERIES ISOLATION TRANSFORMERS. The L-810 series obstruction light does not include a film cutout; therefore, an isolation transformer is required with each series lamp. Double series units of this type require two series insulating transformers. The transformer shall be housed in a base or buried directly in the earth in accordance with the details shown in the plans.

119-3.6 WIRING. The Contractor shall furnish all necessary labor and materials and shall make complete electrical connections from the underground cable or other source of power in accordance with the wiring diagram furnished with the project plans. If underground cable is required for the power feed and if duct is required under paved areas, the cable and duct shall be installed in accordance with and paid for as described in Specification Sections 69 and 71 (FAA Item L-108, Underground Power Cable for Airports, and Item L-110, Airport Underground Electrical Duct Banks and Conduit).

119-3.7 LAMPS. The Contractor shall furnish and install in each unit one or two lamps, as required, conforming to the manufacturer's requirements.

119-3.8 TESTS. The installation shall be fully tested by continuous operation for not less than 1/2 hour as a completed unit prior to acceptance. These tests shall include the functioning of each control not less than 10 times.

MATERIAL REQUIREMENTS

AC 150/5345-7 Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits

AC 150/5345-42 Specification for Airport Light Base and Transformer Housing, Junction Boxes, and Accessories

AC 150/5345-43 Specification for Obstruction Lighting Equipment

AC 150/5345-47 Isolation Transformers for Airport Lighting Systems

ANSI/ICEA S-70-547-1992 Weather-Resistant Polyolefin-Covered Wire and Cable

FED SPEC J-C-30 Cable and Wire, Electrical (Power, Fixed Installation) (cancelled; replaced by AA-59544 Cable and Wire, Electrical (Power, Fixed Installation))

END OF ITEM L-119

74-2 METHOD OF MEASUREMENT

Obstruction lights shall be measured by the number of double, or single obstruction lights installed as complete units in place, accepted by the engineer and ready for operation.

Other wire and cable connections, the furnishing and installing of all necessary conduits and fittings, insulators, pole steps, pole cross arms, the painting of poles and pipes and the furnishing and installing of all lamps and installing of insulating transformers including the servicing and testing of the installation and all incidentals necessary to place the lights in operation as completed units to the satisfaction of the Engineer shall be included in the unit price bid for the work.

74-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for each completed and accepted double or single obstruction light installed by the contractor. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with the provisions and intent of the plans and specifications.

The accepted quantity of wind cones will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

Item 74.1	Single Airport Obstruction Lights	per each
Item 74.2	Double Airport Obstruction Lights	per each

END OF SECTION 74

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. This item shall consist of furnishing and installing obstruction lights

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. Airport lighting equipment and materials shall be certified and listed

2. All equipment and materials shall be subject to acceptance through manufacturer's certification

3. Manufacturer's certifications shall not relieve the Contractor of responsibility

4. All materials and equipment shall be submitted to the Engineer for approval

5. The data submitted shall be sufficient, to determine compliance with the plans

6. All equipment and materials shall be guaranteed against defects for a period of at least twelve (12) months

B. OBSTRUCTION LIGHTS

1. Shall conform to the requirements of AC 150/5345-43

C. ISOLATION TRANSFORMERS

1. Shall conform to the requirements of AC 150/5345-47

D. TRANSFORMER HOUSING

1. Shall conform to AC 150/5345-42

E. CONDUIT

1. For use above ground, rigid steel conduit

F. PLASTIC CONDUIT

1. For below grade only

a) Type I – Schedule 40 PVC

b) Type II – Schedule 40 PVC

G. WIRES

1. Wires in conduit rated up to 5,000 volts shall conform to AC 150/5345 7

H. MISCELLANEOUS

1. Paint, poles, pole steps, insulators, and all other miscellaneous materials

III. CONSTRUCTION METHODS

A. PLACING THE OBSTRUCTION LIGHTS

1. Contractor shall furnish and install single-or double-obstruction lights

B. INSTALLATION ON POLES

1. Obstruction light shall be installed with its hub at least as high as the top of the pole

C. INSTALLATION ON BEACON TOWER

1. Two obstruction lights shall be mounted on top of the beacon tower

D. INSTALLATION ON BUILDINGS, TOWERS, SMOKESTACKS, ETC.

1. The installation shall be made in accordance with details shown in the plans

E. SERIES ISOLATED TRANSFORMERS

1. An isolation transformer is required with each series lamp

F. WIRING

1. The Contractor shall furnish all necessary labor and materials

G. LAMPS

1. Lamps as specified by the manufacturer

H. TESTS

1. The installation shall be fully tested

IV. METHOD OF MEASUREMENT

1. Obstruction lights shall be measured by the number of double, or single obstruction lights

V. BASIS OF PAYMENT

1. Payment will be made at the contract unit price

VI. MATERIAL REQUIREMENTS

1. AC 150/5345-7
2. AC 150/5345-42
3. AC 150/5345-43
4. AC 150/5345-47
5. ANSI/ICEA S-70-547-1992
6. FED SPEC J-C-30

END OF SECTION 74

SECTION 75 – AIRPORT BEACONS (FAA L-101, AND L-103)

75-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for construction of airport beacons in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item L-101 and 103, as included and modified hereafter, and as shown on the Plans.

It shall also include all mandreling, installation of pulling rope, conduit fittings, capping, and the testing of the installation as a completed, operational system, to the satisfaction of the Owner and Engineer. The Contractor shall protect the existing pavement and utilities from damage by use of any equipment with tracks, stabilization feet, hydraulic fluids, etc., during the construction of this item.

ITEM L-101 AIRPORT ROTATING BEACONS

DESCRIPTION

101-1.1 *This item shall consist of furnishing and installing airport rotating beacons. This work shall include the mounting, leveling, wiring, painting, servicing, and testing of the beacon and all materials and incidentals necessary to place the beacons in operating condition as a completed unit to the satisfaction of the Engineer. This item shall include a mounting platform if specified in the plans.*

EQUIPMENT AND MATERIALS

101-2.1 GENERAL.

a. *Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified and listed under Advisory Circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program.*

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or

installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components or electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the Contract Documents plans and specifications. The Contractor's submittals shall be neatly bound. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

101-2.2 BEACON. *The beacon shall meet the requirements of AC 150/5345-12, Specification for Airport Beacons.*

101-2.3 PANEL BOARDS AND BREAKERS. *Panel boards and breakers shall conform to the requirements of Fed. Spec. W-P-115.*

101-2.4 WEATHERPROOF CABINETS. *The weatherproof cabinets shall conform to National Electrical Manufacturers Association Standards and shall be constructed of steel not less than No. 16 USS gauge.*

101-2.5 WIRE. *Wire in conduit rated up to 5,000 volts shall conform to AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits for Rubber Insulated Neoprene Covered Wire, or Fed. Spec. J-C-30, Type RHW, for rubber insulated fibrous covered wire. For ratings up to*

600 volts, the thermoplastic wire conforming to Fed. Spec. J-C-30, Types TW, THW, and THWN, shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

101-2.6 CONDUIT. *Rigid steel conduit and fittings shall conform to the requirements of Underwriters Laboratories Standard 6, 514, and 1242.*

101-2.7 PAINT.

a. *Priming paint for ungalvanized metal surfaces shall be a high solids alkyd primer conforming to TT-P-664D.*

b. Priming paint for galvanized metal surfaces shall be zinc dust-zinc oxide primer paint conforming to MIL-DTL-24441/19B. If necessary, add not more than ½ pint (0.06 liter) of turpentine to each gallon (liter).

c. Orange paint for the body and the finish coats on metal and wood surfaces shall consist of a ready-mixed non-fading paint meeting the requirements of Fed. Spec. TT-E-489. The color shall be in accordance with Federal Standard 595, Aviation Gloss Orange Number 12197.

d. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2.

e. Priming paint for wood surfaces shall be mixed on the job by thinning the above-specified orange or white paint with ½ pint (0.06 mm) of raw linseed oil to each gallon (liter).

CONSTRUCTION METHODS

101-3.1. PLACING THE BEACON. *The beacon shall be mounted on a beacon tower, platform, or building roof as shown in the plans.*

101-3.2 HOISTING AND MOUNTING. *The beacon shall be hoisted to the mounting platform by using suitable slings and hoisting tackle. Before fastening the beacon to the mounting platform, the mounting holes shall be checked for correct spacing. Beacon base or mounting legs shall not be strained or forced out of position to fit incorrect spacing of mounting holes. The beacon base shall be raised first, set in position, and bolted in place. The drum shall then be raised and assembled to the base.*

101-3.3 LEVELING. *After the beacon has been mounted in place, it shall be accurately leveled following manufacturer's instructions. The leveling shall be*

checked in the presence of the Engineer and shall be to the Engineer's satisfaction.

***101-3.4 SERVICING**. Before placing the beacon in operation, the Contractor shall check the manufacturer's manual for proper servicing requirements. Follow the manufacturer's servicing requirements for each size beacon.*

***101-3.5 BEAM ADJUSTMENT**. After the beacon has been mounted and leveled, the elevation of the beams shall be adjusted. The final beam adjustments shall be made at night so that results can be readily observed. The beams shall be adjusted to the elevation directed by the Engineer or as shown in the plans, except that, in no case shall the elevation of the beams be less than 2 degrees above the horizontal.*

***101-3.6 BEACON MOUNTING PLATFORM.** Where the beacon is to be mounted at a location other than the beacon tower and where a special mounting platform is required, the construction of this mounting platform and any necessary lightning protection equipment shall be in accordance with the details shown in the plans.*

***101-3.7 WIRING.** The Contractor shall furnish all necessary labor and materials and shall make complete above ground electrical connections in accordance with the wiring diagram furnished with the project plans. The electrical installation shall conform to the requirements of the latest edition of National Fire Protection Association, NFPA-70, National Electric Code.*

Copies of the National Electric Code may be obtained form the National Fire Protection Associations, Inc., One Batterymarch Park, Quincy, Massachusetts 02269.

If underground cable for the power feed from the transformer vault to the beacon site and duct for this cable installation is required, the cable, ground rods and duct shall be installed in accordance with and paid for as described in Specification Sections 69 and 71 (FAA Item L-108, Underground Power Cable for Airports, and Item L-110, Airport Underground Electrical Duct Banks and Conduit).

Unless otherwise specified, the Contractor shall connect the tell-tale relay mechanism in the beacon to energize the tower obstruction light circuit when failure of the beacon service (primary) lamp occurs.

If lightning protection is specified in the plans or proposal as a part of this item, it shall be installed in accordance with 103-2.3 in Item L-103, Airport Beacon Towers.

101-3.8 PANEL AND CABINET. *Unless otherwise specified, the Contractor shall furnish and install at the top of the beacon tower or mounting platform a circuit-breaker panel consisting of four 15-ampere breakers mounted in a weather-proof cabinet to provide separate protection for the circuits to the beacon lamps, motor, obstruction lights, and other equipment. The cabinet shall be located on the side of the beacon platform, as directed by the Engineer.*

101-3.9 CONDUIT. *All exposed wiring shall be run in not less than ¾ inch (19 mm) galvanized rigid steel conduit. No conduit shall be installed on top of a beacon platform floor. All conduit shall be installed to provide for drainage. If mounted on a steel beacon tower, the conduit shall be fastened to the tower members with "wraplock" straps, clamps, or approved fasteners, spaced approximately 5 feet (150 cm) apart. The conduit shall be fastened to wooden structures with galvanized pipe straps and with galvanized wood screws not less than No. 8 or less than 1-¼ inches (31 mm) long. There shall be at least two fastenings for each 10-foot (3 m) length.*

~~***101-3.10 BOOSTER TRANSFORMER.*** *If shown in the plans or specified in job specifications, a booster transformer to compensate for voltage drop to the beacon shall be installed in a suitable weatherproof housing under or on the tower platform or at the base of the tower. The installation shall be as indicated in the plans and described in the proposal. If the booster transformer is required for installation remote from the beacon, it shall be installed in accordance with and paid for [ ].~~

~~***101-3.11 PHOTOELECTRIC CONTROL.*** *If shown in the plans or specified in job specifications, the Contractor shall furnish and install an automatic control switch at the location indicated in the plans. The switch shall be a photoelectric type. It shall be a standard commercially available unit that will energize when the northern sky illuminance falls below 60 footcandles (645.8 lux) but before reaching a level of 35 footcandles (367.7 lux). The photoelectric switch should de-energize when the northern sky illuminance rises to a level of not more than 60 footcandles (645.9 lux). It shall be installed, connected, and adjusted in accordance with the manufacturer's instructions.~~

101-3.12 OBSTRUCTION LIGHTS. *Unless otherwise specified, the Contractor shall install on the top of the beacon tower or mounting platform two L-810 obstruction lights on opposite corners. These lights shall be mounted on conduit extensions to a height of not less than 4 inches (100 mm) above the top of the beacon. They shall be connected in series into the tell-tale circuit with the necessary relay and wiring connections.*

101-3.13 PAINTING. *If construction of a wooden mounting platform is stipulated in the proposal as part of this item, all wooden parts of the platform shall be given one priming coat of white or aviation-orange paint after*

fabrication but before erection and one body and one finish coat of aviation-orange paint after erection. Steel mounting platforms shall be given one priming coat of corrosion-inhibiting primer before erection and one body and one finish coat of aviation-orange paint after erection. All equipment installed under this contract and exposed to the weather shall be given one body and one finish coat of aviation-orange or white paint as required. This shall include beacon (except glass surfaces), beacon base, breaker cabinet, all conduit, and transformer cases. It shall not include air terminals or obstruction light globes.

The paint shall be applied uniformly in the proper consistency by skilled painters. The finished paint shall be free from sags, holidays, and smears. Each coat of paint shall be given ample time to dry and harden before the next coat of paint is applied. A minimum of 3 days shall be allowed for drying on wood surfaces, and a minimum of 4 days shall be allowed for drying on metal surfaces. Painting shall not be done in cold, damp, foggy, dusty, or frosty atmospheres, or when air temperature is below 40° F (4° C), nor started when the weather forecast indicates such conditions for the day.

All surfaces shall be cleaned before painting. The surfaces shall be dry and free from scale, grease, rust, dust, and dirt when paint is applied. All knots in wood surfaces shall be covered with shellac immediately before applying the priming coat of paint. Nail holes and permissible imperfections shall be filled with putty. The ready-mixed paint shall be thinned for the priming and body coats in accordance with the manufacturer's recommendations. In the absence of such recommendations, the following shall apply:

a. Body coats (for both wood and steel surfaces) - add ½ pint (0.06 liter) of turpentine to each gallon (liter) of ready-mixed paint for body coats.

b. Finish coats (for both wood and steel surfaces) the ready-mixed paint shall be used as it comes from the container for finish coats.

***101-3.14 TESTING**. The installation shall be fully tested in operation as a completed unit prior to acceptance. These tests shall include operation of the lamp-changer operation and taking megger and voltage readings. The insulation resistance to ground of the beacon supply circuit shall be not less than 50 megohms. Testing equipment shall be furnished by the Contractor. Tests shall be conducted in the presence of the Engineer and shall be to the Engineer's satisfaction.*

MATERIAL REQUIREMENTS

AC 150/5345-7 *Specification for L-824 Underground Cable for Airport Lighting Circuits*

AC 150/5345-12 Beacons	*Specification for Airport and Heliport*
FED SPEC J-C-30 Installation)	*Cable and Wire, Electrical (Power, Fixed*
(cancelled; replaced by A-A-59544 Cable and Wire, Electrical (Power, Fixed Installation))	
FED SPEC TT-E-489	*Enamel, Alkyd, Gloss, Low VOC Content*
FED SPEC TT-P-664D Inhibiting, Lead and Chromate Free, VOC-Compliant	*Primer Coating, Alkyd, Corrosion-*
FED SPEC W-P-115	*Panel, Power Distribution*
FED STD 595 Procurement	*Colors Used in Government*
MIL-P-24441/19B Formula 159, Type III	*Paint, Epoxy-Polyamide, Zinc Primer,*
Underwriters Laboratories Standard 6	*Rigid Metal Conduit*
Underwriters Laboratories Standard 514 Boxes	*Fittings for Conduit and Outlet*
Underwriters Laboratories Standard 1242	*Intermediate Metal Conduit*
NFPA-70	*National Electric Code*
NFPA-780 Protection Systems	*Standard for the Installation of Lightning*
Master Painter's Institute	

END OF ITEM L-101

ITEM L-103 AIRPORT BEACON TOWERS

DESCRIPTION

103-1.1 *This item shall consist of furnishing and installing an airport beacon tower of the type shown in the plans, in accordance with these specifications. This work shall include the clearing of the site, erection of the tower, installation of lightning protection, painting, and all incidentals necessary to place it in operating condition as a completed unit to the satisfaction of the Engineer.*

EQUIPMENT AND MATERIALS

103-2.1 GENERAL.

a. *All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.*

b. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

103-2.2 TOWER. *The beacon tower shall conform to the requirements of Advisory Circular (AC) 150/5340-30, Design and Installation Details for Airport Visual Aids, Chapter 6.*

103-2.3 LIGHTNING PROTECTION. *Lightning protection shall comply with NFPA-780, Standard for the Installation of Lightning Protection Systems. All materials shall comply with Class II requirements regardless of tower height. Ground rods and underground cables shall be installed in accordance with and paid for as described in Item L-108, Underground Power Cable for Airports.*

103-2.4 PAINT.

a. Priming paint for galvanized steel towers shall be zinc dust-zinc oxide primer paint conforming to MIL-DTL-24441/19B. If necessary, add not more than 1/2 pint (0.06 liter) of turpentine to each gallon (liter).

b. Priming paint for ungalvanized steel towers shall be a high solids alkyd primer conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2.

c. Orange paint for the body and finished coats on metal and wood surfaces shall consist of a ready-mixed non-fading paint meeting the requirements of Fed. Spec. TT-E-489. The color shall be in accordance with Federal Standard 595, Aviation Gloss Orange Number 12197.

d. White paint for steel tower shall be ready-mixed paint conforming to Commercial Item Description A-A-3067.

CONSTRUCTION METHODS

103-3.1 CLEARING AND GRADING. *The site on which the beacon tower is to be erected shall be cleared and leveled. All trees and brush shall be removed from the area within a distance of 25 feet (7.5 m) from the tower or as called for in the plans. Stumps shall be removed to a depth of 18 inches (45 cm) below finished grade and the excavation filled with earth and tamped. If a transformer vault or other structure is included as part of the installation, the area shall be cleared to a distance of 25 feet (7.5 m) from these structures. The ground near the tower shall be leveled to permit the operation of mowing machines. The leveling shall extend at least 2 feet (60 cm) outside the tower legs. All debris*

removed from the tower site shall be disposed of by the Contractor to the satisfaction of the Engineer and in accordance with Federal, state, or local regulations.

103-3.2 EXCAVATION AND FILL. *Excavation for the tower footings shall be carried to a minimum of 4 inches (100 mm) below the footing depth. The excess excavation below the footing depth shall then be backfilled with gravel or crushed stone and compacted to the required level. The footing plates shall be installed, and a thickness of not less than 18 inches (45 cm) of the same gravel or crushed stone shall be placed immediately above the footing plates in layers of not over 6 inches (150 mm). Each layer above the footing plates shall be thoroughly tamped in place. The remainder of the backfill may be of excavated earth placed in layers not to exceed 6 inches (150 mm). Each layer shall be thoroughly compacted by tamping.*

Where solid rock is encountered, which prevents the carrying of the foundation legs to the required depth but which is of sufficient strength to use holddown bolts, the tower anchor posts shall be cut off at the required length and the holddown bolts shall be installed as indicated in the plans with the approval of the Engineer. Each tower leg shall be anchored to the rock by means of two 7/8-inch (21 mm) diameter by 3-foot (90 cm) long expansion or split bolts and shall be grouted with neat portland cement into holes drilled into the natural rock. Except as required for rock foundations, the footing members shall not be cut off or shortened. If excavated material is of such character that it will not readily compact when backfilled, the Engineer may order the excavation backfilled with concrete or other suitable material.

The concrete footing for tubular beacon towers shall be installed in accordance with the manufacturer's recommendations. Portions of the footing in the topsoil layer shall not be included in the footing height.

103-3.3 ERECTION. *Detail erection drawings furnished by the manufacturer shall be strictly followed during construction. All towers shall be erected in sections from the ground up unless otherwise specified. In final assembly, all bolts and fastenings shall be installed, and the structure shall be plumb, true, square, and level. Nuts shall be taken up to a firm bearing after which the bolts shall, if necessary, be cut to proper length to protrude three full threads. Approved locknuts shall be placed on each bolt over the regular nut. Ladder bolts shall be inserted with the head to the outer face of the tower. Diagonal, leg, and handrail bolts shall be installed with nuts on the outer face of the tower, unless otherwise specified. Bent parts shall be straightened before erection without damage to the protective coating. Surfaces abraded or bared of protective coating shall be painted with the proper priming paint as specified in these specifications.*

The Contractor shall install the ladder on the side of the tower adjacent to the driveway or most accessible approach to the tower. Tubular beacon towers shall be erected in accordance with the manufacturer's recommendations. The safety cable shall be located on the side of the tower adjacent to the driveway or most accessible approach to the tower.

103-3.4 LIGHTNING PROTECTION. *The Contractor shall furnish and install an air terminal, down conductor, and at least one ground plate or rod for each beacon tower or as indicated in the plans. The air terminal shall be installed at the top of the tower with the tip of the rod extending not less than 6 inches (150 mm) above the top of the beacon.*

Down-conductor cables shall be securely fastened to the surface of the tower leg at 5-foot (150 cm) intervals with suitable bronze fasteners having bronze or noncorrosive metal bolts. Sharp turns or bends in the down conductor will not be permitted.

All connections of cable to cable, cable to air terminals, and cable to ground plates or rods shall be made with solderless connectors or noncorrosive metal approved by the engineer and shall be of substantial construction.

The down-conductor cable shall be securely attached to ground rods or plates placed at least 2 feet (60 cm) away from the tower foundations. The ground rod shall be driven into the ground so that the top is at least 6 inches (150 mm) below grade. The down-conductor shall be firmly attached to the ground plate or rod by means of a ground connector or clamp. Plates shall be embedded in the area of permanent moisture.

The complete lightning protection installation shall be accomplished to the satisfaction of the Engineer. The resistance to ground of any part of the lightning protection system shall not exceed 25 ohms.

103-3.5 PAINTING. *The Contractor shall furnish all materials and labor for painting the beacon tower. The color scheme for the steel tower shall be as shown in the plans.*

a. Parts to be Painted*. Tower parts (except those parts to be exposed to earth) shall not be treated or primed before erection. All tower parts placed below ground level or within 12 inches (300 mm) above ground level shall be given two coats of approved bituminous paint.*

The paint shall be applied uniformly in the proper consistency by skilled painters. The finished paint shall be free from sags, holidays, and smears. Division lines between colors shall be sharply defined. Each coat of paint shall be given ample time to dry and harden before the next coat is applied. A minimum of 4 days shall

be allowed for drying on metal surfaces. Painting shall not be done in cold, damp, foggy, dusty, or frosty atmospheres, or when air temperature is below 40° F (4° C), nor started when the weather forecast indicates such conditions for the day.

All surfaces shall be cleaned before painting. The surfaces shall be dry and free from scale, grease, rust, dust, and dirt when paint is applied.

The number of coats of paint applied shall be in accordance with the following instructions:

***b. Steel Towers, Galvanized**. One priming coat of zinc dust-zinc oxide primer after erection and one body and one finish of white or orange paint (as required by the color scheme) shall be applied after erection.*

***c. Steel Towers, Not Galvanized**. One priming coat of corrosion-inhibiting primer and one body and one finish coat of white or orange paint (as required by the color scheme) shall be applied after erection.*

The above specified orange and white ready-mixed paints shall be thinned for the body coats in accordance with the manufacturer's recommendations. In the absence of such recommendations, the following shall apply:

***d. Body Coats.** Add not more than 1/2 pint (0.06 liters) of turpentine to each gallon (liter) of ready-mixed paint for body coats.*

***e. Finish Coats.** The ready-mixed paint shall be used as it comes from the container for finish coats.*

MATERIAL REQUIREMENTS

AC 150/5340-30 Visual Aids	*Design and Installation Details for Airport*
FED SPEC TT-E-489	*Enamel, Alkyd, Gloss, Low VOC Content*
FED STD 595 Procurement	*Colors Used in Government*
MIL-DTL-24441/19B Formula 159, Type III	*Paint, Epoxy-Polyamide, Zinc Primer,*
NFPA-780 Protection Systems	*Standard for the Installation of Lightning*

Master Painter's Institute

END OF ITEM L-103

75-2 METHOD OF MEASUREMENT

Beacons and associated beacon towers shall be measured by the number of beacons and towers installed as complete units in place, accepted by the engineer and ready for operation.

Other mounting, leveling, wiring, painting, servicing, and testing of the beacon and all materials and incidentals necessary to place the beacons in operating condition as a completed unit to the satisfaction of the Engineer, as well as mounting platform if specified in the plans and the clearing of the site, erection of the tower, installation of lightning protection, painting, and all incidentals shall be included in the unit price bid for the work.

75-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for each completed and accepted airport rotating beacon and tower installed by the contractor. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with the provisions and intent of the plans and specifications.

The accepted quantity of airport rotating beacons and towers will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

Item 75.1 Beacon Tower ..... per each

Item 75.2 Airport Rotating Beacon ..... per each

END OF SECTION 75

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Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

FAA ITEM L-101

I. DESCRIPTION

A. GENERAL

1. This item shall consist of furnishing and installing airport rotating beacons

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. Airport lighting equipment and materials shall be certified and listed
2. All equipment and materials shall be subject to acceptance through manufacturer's certification
3. Manufacturer's certifications shall not relieve the Contractor of responsibility
4. All materials and equipment shall be submitted to the Engineer for approval
5. The data submitted shall be sufficient, to determine compliance with the plans
6. All equipment and materials shall be guaranteed against defects for a period of at least twelve (12) months

B. BEACON

1. Shall meet the requirements of AC 150/5345-12

C. PANEL BOARDS AND BREAKERS

1. Shall conform to the requirements of Fed. Spec. W-P-115

D. WEATHERPROOF CABINETS

1. Shall conform to National Electrical Manufacturers Association Standards

E. WIRES

1. Wires in conduit rated up to 5,000 volts shall conform to AC 150/5345 7

F. CONDUIT

1. For use above ground, rigid steel conduit

G. PAINT

1. Priming paint for ungalvanized metal surfaces

2. Priming paint for galvanized metal surfaces

3. Orange paint for the body and the finish coats

4. White paint for body and finish coats

5. Priming paint for wood surfaces

III. CONSTRUCTION METHODS

A. PLACING THE BEACON

1. The beacon shall be mounted on a beacon tower

B. HOISTING AND MOUNTING

1. Shall be hoisted to the mounting platform by using suitable slings and hoisting tackle

C. LEVELING

1. It shall be accurately leveled following manufacturer's instructions

D. SERVICING

1. Contractor shall check the manufacturer's manual for proper servicing requirements

E. BEAM ADJUSTMENT

1. The final beam adjustments shall be made at night

F. BEACON MOUNTING PLATFORM

1. Shall be in accordance with the details shown in the plans

G. WIRING

1. The Contractor shall furnish all necessary labor and materials

H. PANEL AND CABINET

1. Contractor shall furnish and install at the top of the beacon tower

I. CONDUIT

1. All exposed wiring shall be in galvanized rigid steel conduit

~~J. BOOSTER TRANSFORMER~~

~~K. PHOTOELECTRIC CONTROL~~

L. OBSTRUCTION LIGHTS

1. Contractor shall install two L-810 obstruction lights on opposite corners

M. PAINTING

1. Paint shall be applied uniformly in the proper consistency by skilled painters

a) Body coats

b) Finish coats

N. TESTS

1. The installation shall be fully tested

IV. METHOD OF MEASUREMENT

1. Beacons shall be measured by the number of beacons installed

V. BASIS OF PAYMENT

1. Payment will be made at the contract unit price

VI. MATERIAL REQUIREMENTS

1. AC 150/5345-12
2. FED SPEC J-C-30
3. FED SPEC TT-E-489
4. FED SPEC TT-P-664D
5. FED SPEC W-P-115
6. FED STD 595
7. MIL-P-24441/19B
8. Underwriters Laboratories Standard 6
9. Underwriters Laboratories Standard 514
10. Underwriters Laboratories Standard 1242
11. NFPA-70

12. NFPA-780

13. Master Painter's Institute

FAA ITEM L-103

I. DESCRIPTION

O. GENERAL

1. This item shall consist of furnishing and installing an airport beacon tower

II. EQUIPMENT AND MATERIALS

P. GENERAL

1. All equipment and materials shall be subject to acceptance through manufacturer's certification

2. Manufacturer's certifications shall not relieve the Contractor of responsibility

3. All materials and equipment shall be submitted to the Engineer for approval

4. The data submitted shall be sufficient, to determine compliance with the plans

5. All equipment and materials shall be guaranteed against defects for a period of at least twelve (12) months

Q. TOWER

1. Shall conform to the requirements of AC 150/5340-30

R. LIGHTNING PROTECTION

1. Shall comply with NFPA-780

S. PAINT

1. Priming paint for galvanized steel towers

2. Priming paint for ungalvanized steel towers

3. Orange paint for the body and the finish coats

4. White paint for steel tower

III. CONSTRUCTION METHODS

T. CLEARING AND GRADING

1. The site on which the beacon tower is to be erected shall be cleared and leveled

U. EXCAVATION AND FILL

1. Excavation for the footings shall be a minimum of 4 inches below the footing

V. ERECTION

1. Erection drawings furnished by the manufacturer shall be strictly followed

W. LIGHTNING PROTECTION

1. Contractor shall provide an air terminal, down conductor, and ground plate or rod

X. PAINTING

1. Contractor shall furnish all materials and labor for painting the beacon tower

a) Parts to be painted

b) Steel towers, Galvanized

c) Steel towers not Galvanized

d) Body coats

e) Finish coats

IV. METHOD OF MEASUREMENT

2. Beacon towers shall be measured by the number of beacon towers installed

V. BASIS OF PAYMENT

3. Payment will be made at the contract unit price

VI. MATERIAL REQUIREMENTS

4. AC 150/5340-30

5. FED SPEC TT-E-489

6. FED STD 595

7. MIL-DTL-24441/19B

8. NFPA-780

9. Master Painter's Institute

END OF SECTION 75

SECTION 76 – ADHESIVE COMPOUNDS, TWO-COMPONENT FOR SEALING WIRE AND LIGHTS IN PAVEMENT (FAA P-606)

74-1 GENERAL

The Contractor shall perform all work required by the plans and specifications for materials to seal wire and lights in pavement in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-606, as included and modified hereafter, and as shown on the Plans.

For conduits installed in existing concrete, contractor shall provide 6" deep by 4" wide saw kerf in existing pavement including ½" by ½" by 3" solid steel bar, placed 5'-0" on center, for conduit support and a 3/4" wide spring steel cap conduit retainer every 5' minimum.

Conduit to be installed in saw kerf shall be 2" rigid galvanized steel conduit, hot dipped galvanized inside and out and conforming to the requirements of Underwriters Laboratories Standard 6, 514B, and 1242.

ITEM P-606 ADHESIVE COMPOUNDS, TWO-COMPONENT FOR SEALING WIRE AND LIGHTS IN PAVEMENT

DESCRIPTION

606-1.1. *This specification covers two types of material; a liquid suitable for sealing electrical wire in saw cuts in pavement and for sealing light fixtures or bases in pavement, and a paste suitable for embedding light fixtures in the pavement. Both types of material are two-component filled formulas with the characteristics specified in paragraph 606-2.4. Materials supplied for use with bituminous concrete pavements must be formulated so they are compatible with the bituminous concrete.*

EQUIPMENT AND MATERIALS

606-2.1 CURING*. When prewarmed to 77°F (25°C), mixed, and placed in accordance with manufacturer's directions, the materials shall cure at temperatures of 45°F (7°C) or above without the application of external heat.*

606-2.2 STORAGE*. The adhesive components shall not be stored at temperatures over 86°F (30°C).*

606-2.3 CAUTION*. Installation and use shall be in accordance with the manufacturer's recommended procedures. Avoid prolonged or repeated contact with skin. In case of contact, wash with soap and flush with water. If taken*

internally, call doctor. Keep away from heat or flame. Avoid vapor. Use in well-ventilated areas. Keep in cool place. Keep away from children.

***606-2.4 CHARACTERISTICS**. When mixed and cured in accordance with the manufacturer's directions, the materials shall have the following properties shown in Table 1.*

SAMPLING, INSPECTION, AND TEST PROCEDURES

***606-3.1 TENSILE PROPERTIES.** Tests for tensile strength and elongation shall be conducted in accordance with ASTM D 638.*

***606-3.2 EXPANSION.** Tests for coefficients of linear and cubical expansion shall be conducted in accordance with ASTM D 1168, Method B, except that mercury shall be used instead of glycerine. The test specimen(s) shall be mixed in the proportions specified by the manufacturer, and cured in a glass tub approximately 2 inches long by 3/8 inch in diameter. The interior of the tube shall be precoated with a silicone mold release agent. The hardened sample shall be removed from the tube and aged at room temperature for 1 week before conducting the test. The test temperature range shall be from 35°F (2°C) to 140°F (60°C).*

***606-3.3 TEST FOR DIELECTRIC STRENGTH.** Test for dielectric strength shall be conducted in accordance with ASTM D 149 for sealing compounds to be furnished for sealing electrical wires in pavement.*

Table 1
PROPERTY REQUIREMENTS

Physical or Electrical Property	*Minimum*	*Maximum*	*ASTM Method*
Tensile			
Portland Cement Concrete	*1,000 psi*		*D 638*
Bituminous Concrete	*500 psi*		
Elongation			
Portland Cement Concrete	*8%[a]*		*D 638*
Bituminous Concrete	*50%*		*D 638*
Coef. Of cub. exp. cu. Cm/cu. cm/degree C	*0.00090*	*0.00120*	*D 1168*
Coef. Of lin. Exp. cm/cm/degree C	*0.00030*	*0.00040*	*D 1168*
Dielectric strength, short time test	*350 volts/mil.*		*D 149*

Arc resistance	*125 secs.*		*D 495*
Adhesion to steel	*1,000 psi*		
Adhesion to portland cement concrete	*200 psi*		
Adhesion to asphalt concrete	*(no test available)*		
**20% or more (without filler) for formulations to be supplied for areas subject to freezing.*			

606-3.4 TEST FOR ARC RESISTANCE. *Test for arc resistance shall be conducted in accordance with ASTM D 495 for sealing compounds to be furnished for sealing electrical wires in pavement.*

606-3.5 TEST FOR ADHESION TO STEEL. *The ends of two smooth, clean, steel specimens of convenient size (1 inch by 1 inch by 6 inches would be satisfactory) when bonded together with adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure on a Riehle (or similar) tensile tester. The thickness of adhesive to be tested shall be 1/4 inch.*

606-3.6 ADHESION TO PORTLAND CEMENT CONCRETE

a. Concrete Test Block Preparation. *The aggregate grading shall be as shown in Table 2.*

The coarse aggregate shall consist of crushed rock having a minimum of 75% of the particles with at least one fractured face and having a water absorption of not more than 1.5%. The fine aggregate shall consist of crushed sand manufactured from the same parent rock as the coarse aggregate. The concrete shall have a water-cement ratio of 5.5 gallons of water per bag of cement, a cement factor of 6, plus or minus 0.5, bags of cement per cubic yard of concrete, and a slump of 2-1/2 inches, plus or minus 1/2 inch. The ratio of fine aggregate to total aggregate shall be approximately 40% by solid volume. The air content shall be 5.0%, plus or minus 0.5%, and it shall be obtained by the addition to the batch of an air-entraining admixture such as vinsol resin. The mold shall be of metal and shall be provided with a metal base plate. Means shall be provided for securing the base plate to the mold. The assembled mold and base plate shall be watertight and shall be oiled with mineral oil before use. The inside measurement of the mold shall be such that several 1-inch by 2-inch by 3-inch test blocks can be cut from the specimen with a concrete saw having a diamond blade. The concrete shall be prepared and cured in accordance with ASTM C 192.

TABLE 2. AGGREGATE FOR BOND TEST BLOCKS

Table 2 AGGREGATE FOR BOND TEST BLOCKS		
Type	**Sieve Size**	**Percent Passing**
Coarse Aggregate	3/4 inch	97 to 100
	1/2 inch	63 to 69
	3/8 inch	30 to 36
	No. 4	0 to 3
Fine Aggregate	No. 4	100
	No. 8	82 to 88
	No. 16	60 to 70
	No. 30	40 to 50
	No. 50	16 to 26
	No. 100	5 to 9

b. Bond Test. *Prior to use, oven-dry the test blocks to constant weight at a temperature of 220 to 230°F (104°C to 110°C), cool to room temperature, 73.4 plus or minus 3°F (23°C plus or minus 1.6°C), in a desiccator, and clean the surface of the blocks of film or powder by vigorous brushing with a stiff-bristled fiber brush. Two test blocks shall be bonded together on the 1-inch by 3-inch sawed face with the adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure in a Riehle (or similar) tensile tester. The thickness of the adhesive to be tested shall be 1/4 inch.*

606-3.7 COMPATIBILITY WITH ASPHALT CONCRETE. *Test for compatibility with asphalt in accordance with ASTM D 5329.*

606-3.8 ADHESIVE COMPOUNDS - CONTRACTOR'S RESPONSIBILITY. *The Contractor shall furnish the vendor's certified test reports for each batch of material delivered to the project. The report shall certify that the material meets specification requirements and is suitable for use with portland cement concrete. The report shall be delivered to the Engineer before permission is granted for use of the material. In addition the Contractor shall obtain a statement from the supplier or manufacturer that guarantees the material for one year. The supplier or manufacturer shall furnish evidence that the material has performed satisfactorily on other projects.*

606-3.9 APPLICATION. *Adhesive shall be applied on a dry, clean surface, free of grease, dust, and other loose particles. The method of mixing and application shall be in strict accordance with the manufacturer's recommendations.*

METHOD OF MEASUREMENT

606-4.1 *See Section 74-2.*

BASIS OF PAYMENT

606-5.1 *See Section 74-3.*

TESTING REQUIREMENTS

ASTM C 192	*Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory.*
ASTM D 149	*Tests for Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies.*
ASTM D 495	*Test for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation Materials*
ASTM D 638	*Test for Tensile Properties of Plastics*
ASTM D 1168	*Test for Hydrocarbon Waxes Used for Electrical Insulation*
ASTM D 5329	*Joint Sealants, Hot-poured, for Concrete and Asphalt Pavements*

END OF ITEM P-606

74-2 METHOD OF MEASUREMENT

Conduit installed in saw kerf shall be measured by the number of linear feet (meters) of rigid metal conduit installed in saw kerf, ready for operation, and accepted as satisfactory.

The cost of all saw cutting, backfill, steel support blocks, steel spring clips, adhesive compounds, two-component for sealing wire in pavement, dewatering and restoration of surrounding pavement shall be included in the unit price bid for the work.

No separate measurement of adhesive compounds, two-component for sealing wire and lights in pavement as described herein shall be made but it shall be considered incidental to associated electrical bid items.

74-3 BASIS OF PAYMENT

Payment will be made at the contract unit price for rigid metal conduit installed in saw kerf installed by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Saw cutting, backfill, steel support blocks, steel spring clips, adhesive compounds, two-component for sealing wire and lights in pavement, dewatering and restoration of surrounding pavement will not be measured for payment but will be considered incidental to the associated bid item.

END OF SECTION 76

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Section 76 – ADHESIVE COMPOUNDS, TWO COMPONENT FOR SEALING WIRE AND LIGHTS IN PAVEMENT AND SAW KERF
(FAA P-606)

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. This specification covers two types of adhesive material

2. Saw kerf in existing concrete

3. Conduit to be installed in saw kerf

II. EQUIPMENT AND MATERIALS

A. CURING

1. Materials shall cure at temperatures of 45°F

B. STORAGE

1. Shall not be stored at temperatures over 86°F

C. CAUTION

1. Use in accordance with the manufacturer's recommended procedures

D. CHARACTERISTICS

1. Materials shall have the properties shown in Table 1

E. CONDUIT

1. Shall be 2" rigid galvanized steel conduit

III. CONSTRUCTION METHODS

F. SAW KERF

1. Contractor shall provide 6" deep by 4" wide saw kerf

IV. SAMPLING, INSPECTIONS, AND TEST PROCEDURES

G. TENSILE PROPERTIES

1. Shall be conducted in accordance with ASTM D 638

H. EXPANSION

1. Shall be conducted in accordance with ASTM D 1168

I. TEST FOR DIELECTRIC STRENGTH

1. Shall be conducted in accordance with ASTM D 149

TABLE 1 – PROPERTY REQUIREMENTS

J. TEST FOR ARC RESISTANCE

1. Shall be conducted in accordance with ASTM D 495

K. TEST FOR ADHESION TO STEEL

1. Shall be tested to failure on a Riehle

L. ADHESION TO PORTLAND CEMENT CONCRETE

1. Concrete Test Block Preparation

2. Bond Test

TABLE 2 – AGGREGATE FOR BOND TEST BLOCKS

M. COMPATIBILITY WITH ASPHALT CONCRETE

1. Shall be in accordance with ASTM D 5329

N. ADHESIVE COMPOUNDS – CONTRACTOR'S RESPONSIBILITY

1. Contractor shall furnish the vendor's certified test reports

O. APPLICATION

1. Adhesive shall be applied on a dry, clean surface

V. METHOD OF MEASUREMENT

1. Conduit in saw kerf shall be measured by the number of linear feet

2. Saw cutting, and adhesive compounds shall be included in unit price

VI. BASIS OF PAYMENT

1. Payment will be made at the contract unit price

VII. MATERIAL REQUIREMENTS

1. ASTM C 192
2. ASTM D 149
3. ASTM D 495
4. ASTM D 638
5. ASTM D 1168
6. ASTM D 5329

END OF SECTION 76

SECTION 77 – FIBER OPTIC CABLE AND AIRFIELD LIGHTING CONTROL AND MONITORING SYSTEM (ALCMS)

77- 1 DESCRIPTION

The Contractor shall perform all work required by the plans for construction of new fiber optic cables and modifications to the Airport Lighting Control and Monitoring System (ALCMS) and appurtenant equipment and structures in accordance with this specification and other referenced specifications, as included and modified hereafter, and as shown on the Plans.

Because of the specialized nature of this work, the Contractor or subcontractor performing the work shall meet the pre-qualification requirements set forth herein.

77-1.1 BACKGROUND

The existing ALCMS is manufactured and supplied by Crouse-Hinds Airfield Lighting Products. The modification to the existing system shall be carried out by the Contractor, with the participation of Crouse-Hinds Airfield Lighting Product Company, or by an equally capable manufacturer, having experience in the existing ALCMS.

77-1.2 QUALIFICATIONS

The replacement of the fiber optic cables and appurtenant systems involve systems and modifications to ALCMS are extremely critical for the safe operation of the Airport. Because of the critical, and highly specialized, nature of the work and equipment, modifications to the ALCMS will require the Contractor or specialty subcontractor to be highly experienced and qualified. The Contractor shall ensure that:

(1) That the Contractor or Sub-contractor is a specialized installation contractor in this field.
(2) That the Contractor or Sub-contractor currently has, or within the last year, has contracted with the FAA or other airport agencies to perform similar work.
(3) That the Contractor or sub-contractor has at least 5 years experience with similar fiber optic installations, including coordinating and testing.

77-1.3 SUBMITTAL OF QUALIFICATIONS

On or within two (2) weeks after the date of the Notice to Proceed, the Contractor shall submit a complete qualification package to LAWA presenting the qualifications and experience of the firm proposed to perform the modifications to the fiber optics system and existing ALCMS. The manufacturer shall demonstrate knowledge of the existing system, listed in FAA Approved Equipment List AC-150/5345-53, and shall be an FAA Approved Supplier of L890 Airport Lighting Control and Monitoring Systems. Included shall be detailed resumes of the proposed on-site Supervisor and Project Manager for the fiber optics and ALCMS work. LAWA may reject the proposed firm and request substitution prior to awarding the contract if the requirements of this specification are deemed not to have been met.

The ALCMS modifications supplier must demonstrate the ability to use the existing system hardware and software and integrate the modification to the existing system under this contract.

77-1.4 PROJECT SCOPE

Fiber optic system modifications shall consist of furnishing and installing all underground fiber optic cable, inner duct, in accordance with these specifications at the locations shown in the plans. Modifications shall include splicing, critical operational fiber optic transfers, cable marking and testing of installation and all incidentals necessary to place the cable in operating condition as a complete unit to the satisfaction of the Engineer. The work shall include providing cables, cutting old cable to create slack for splicing, splicing cables, labeling, re-termination, coordinating cutovers with the involved agencies, and testing.

Conduit, duct bank, pullboxes and associated construction methods are covered in Sections 71 and 72 of these Specifications, and power and grounding cables are covered in Section 69 of these Specifications.

When new cable runs are installed, and cutover from existing systems are ready to be made, a period of shutdown will be coordinated with LAWA for cutover. These shutdown periods will likely be late night/early morning and/or weekends, and will be limited to a 4 hour duration.

a. Fiber Cut LAWA ALCMS

A. Agencies involved

(1) FAA
(2) LAWA IT
(3) Airfield Ops
(4) LAWA Electric Shop

B. Affected Circuits

(1) Airfield Lighting Circuits

C. Required Work/Restrictions

(1) Perform all new work prior to cutting existing conduit run. Coordinate cutting/splicing with owner/operator agency.
(4) Contractor shall fusion-splice the existing pulled-back cables to the newly installed bypass cable.
(5) After splices are complete, Contractor shall contact LAWA Inspection to have Airfield Operations and LAWA Electrical Shop verify that all circuits are operational.

D. Test Points

(1) ATCT.
(2) Airfield Electrical Vault.

E. Cable

(1) Corning Cable Systems ALTOS® LST™ 12 fiber cable:

b. ALCMS Scope of Work

A. Existing Airfield Lighting Vaults contain Constant Current Regulators (CCRs) which provide power and control for the airfield lighting system. There are Crouse-Hinds "Digitrac" and "Megatrac" control cabinets for each of the CCRs.

B. Due to runway and taxiway airfield work, the graphic displays at Airfield Lighting Vaults No. 1, No. 2N, No. 2S, No. 3, Maintenance Facility and Control Tower shall be modified to include the changes. The Contractor will incorporate all necessary software and hardware changes required to accommodate the new construction into the existing system.

C. All Digitrac/Megatrac control cabinets located in Airfield Lighting Vaults No. 1, 2N, 2S, and 3 that are affected by the modifications under this contract shall be re-calibrated to accommodate the changes.

D. The scope of work also includes software, programming, calibration, on-site commissioning, on-site testing, on-site training, all system manuals, and any other materials, tools and equipment to provide a fully functional and complete system to the satisfaction of owner.

c. Fiber Optic Installation Equipment Specifications

(1) Stripping Tools

a. Chemical and mechanical stripping methods and materials shall be of a design that will not damage the optical fiber or termination elements.
b. Fixed fiber diameter tools shall be capable of removing the coating from one specific fiber diameter (e.g., 125 microns).
c. Variable fiber diameter tools shall be capable of removing the coating from a range of fiber diameters. This shall be accomplished by using interchangeable die to accommodate the different fiber diameters.

(2) Cleaving Tools

a. Fiber cleaving tools shall be of a design that will allow a clean; fragment-free, crack-free cleave which minimizes chips or other defects on the cleaved fiber end.
b. A precision fiber cleaver shall be used for cleaving the fiber to the proper length with a typical cleave angle within 0.7° of perpendicular.
c. The cleaving tool shall be capable of allowing the operator to control the strip length of the fiber in order to meet engineering documentation requirements.
d. Acceptable Products: Alcoa AFL CT-20 Fiber Cleaver or equal.

(3) Splicing Tools

a. The Contractor shall use a fusion splicer that has the following specifications:

1) Core-to-core fiber profile alignment system (PAS).
2) Full automatic operation.
3) 2 CCD cameras, no up-down mirror.
4) High resolution LCD monitor.
5) Simultaneous X & Y axes observation.
6) Automatic arc calibration function for stable arc discharge.
7) Automatic fiber type identifier and self diagnostic test function.
8) Typical 0.02dB with SM fiber, typical 0.01dB with MM fiber.

b. Acceptable Products: Alcoa Fujikura FSM-40S Splicer or equal.

(4) Inner Duct

a. All inner ducts for fiber optic cable are to be of the corrugated type. Inner ducts that share a common 4"C conduit shall have different color tracing identifiers, (blue, orange, and green).
b. Inner duct shall have measured mule tape inside. All inner-duct shall be corrugated, 1" in size, as indicated shown on the plans.

d. ALCMS Fiber

Fiber for ALCMS Fiber shall be: Corning Cable Systems ALTOS® LST™ 12 fiber cable with twelve 62.5 multimode fibers in two six fiber loose tube jell filled buffer tubes with PE outer jacket, dielectric central member, ripcord, Water-Swellable Tape and Colored Optical Fibers.

e. Fiber Optic Splice Case

A. Preform Line Products Coyote Runt closure

1) Preform Line Products Coyote 12 fiber splice trays.
2) Preform Line Products Runt Manhole Support Kits.

77-1.5 INSTALLATION METHOD OF CABLES

A. All rack steps will have rack clips installed to keep rack steps attached to racks.
B. With regards to fiber optic cable, at every 1300' interval between underground pullboxes, 50' of slack shall be secured to two rack steps anchored on one side of pull box.
C. FAA fiber optic inner duct and cable may travel in the same duct bank with the 2400volt FAA power cable with no separation, although the two cables shall be in their own respective conduits.

77-1.6 INSTALLATION OF DUCT OR CONDUIT

A. Inner duct coupling is to occur only by matching color trace on inner duct at either end of pull box, manhole, etc. Couplers are to be used in manholes, pull boxes, or vaults only. No couplers are to be used and pulled into duct bank.
B. A magnetic caution tape is to be placed over all duct banks in their entirety from box to box.

77-1.7 CABLE CUT OVERS

A. All cable cuts must be coordinated between the Contractor and all involved agencies. Proposed cut plan must be submitted to all agencies and times and methods must be approved before proceeding.

77-1.8 FIBER OPTIC CABLE TERMINATING

A. The Contractor shall only fusion-splice pigtails that have had the connectors installed and polished by the manufacturer or local cable assembly house. The Contractor shall not install or polish fiber optic connectors, either in the field or in his shop.
B. ST pre-connectorized, pre-terminated, pigtails shall be fusion spliced to the cable.
C. Fiber optic cable used in the assembly of the pigtails shall have similar optical characteristics as the installed fiber optic backbone cable.

D. Mechanical splices are not permitted.
E. The Contractor shall protect all fusion splices with rod-reinforced heat-shrink protective sleeves and installed in a specified splice tray.

77-1.9 TESTING

A. All working Fibers shall be verified with assigned agency to check that working circuit is working after cut. If circuit is not operational, fibers must be tested to find reason for failure and corrected.
B. All vacant fibers shall be OTDR tested and results provided to the Communication Center. The accepted splice loss for single mode and multimode fibers shall be equal than or less than .15 dB. Multimode shall be tested at 850nm, and Single mode shall be tested at 1310 nm. If the splice point is greater than .15 db it must be re-spliced. If it still fails Fiber can be bi-directionally tested and if the average of the splice loss value is below .15db the splice will be accepted.

77-1.10 OTHER REFERENCED SPECS

Installation of conduit, duct, duct bank, power and communication cables shall be as specified in Sections 71 and 72 of these Specifications.

77-1.11 PROJECT COORDINATION

A. ALCMS upgrade manufacturer shall provide an experienced and qualified technician to support the Contractor and LAWA airport throughout the installation and warranty period of the system.
B. The ALCMS modification work requires close coordination and scheduling with the Engineer, LAWA, and FAA. When the work requires access to the Airfield Lighting Vaults, Maintenance Facility, Control Tower and other areas, the Contractor shall give 2 weeks prior notice to the Engineer for scheduling the work.
C. Contractor shall furnish a work schedule describing the basic cycle of events and sequence of work, to the Engineer for review, prior to the start of the project.

77-1.12 INSTALLATION AND COMMISSIONING

A. The installing contractor shall be responsible for the physical installation of all associated ALCMS upgrade components.

B. Manufacturer shall perform as a minimum, the following installation and commissioning tasks:

(1) Verify Contractor connections including power, control and monitoring.
(2) Perform all hardware calibrations.
(3) Perform system testing including control, monitoring and diagnostic.
(4) Perform System Acceptance Testing (SAT).

77-1.13 SYSTEM ACCEPTANCE TEST (SAT)

A. Detailed field test plan shall be submitted to the Engineer for review.

B. Following the final installation, commissioning and calibration of the system, manufacturer shall perform on-site a demonstration of the system performance. This demonstration shall include but not limited to, the following:

(1) Control functions
(2) Monitoring functions
(3) Surveillance functions
(4) Alarm functions
(5) Print functions
(6) Display functions

The SAT must be witnessed by the Engineer and LAWA. The SAT must demonstrate operation of the software and hardware to the satisfaction of the Engineer and LAWA. A report of the SAT must be provided by the manufacturer when the testing is complete and results accepted by the Engineer.

C. As part of the SAT, the system must also complete one (1) week of continuous operation.

77-1.14 AS-BUILT DRAWINGS

A. Contractor shall provide updated as-built drawings incorporating the modifications to the ALCMS.

77-1.15 OPERATION AND MAINTENANCE MANUALS

A. Manufacturer shall provide six (6) typewritten, easy to understand hard cover instruction manuals suitable for daily operation and maintenance of the system. The instruction manuals shall include as a minimum the following information:

(1) Operational overview and system description
(2) Logic and block diagrams
(3) Graphical User Interface Screen operation
(4) User configuration tools instruction manual
(5) System Block Diagram
(6) Drawings and data sheets of major system components
(7) Detailed external wiring diagrams (Electrical Contractor wiring)
(8) Detailed assembly drawings and wiring diagrams
(9) Original Equipment Manufacturer (OEM) Manuals

B. Manufacturer shall provide six (6) operation manuals for the Air Traffic Controllers (ATC) that are hard-covered and suitable for daily operation of the system. As a minimum, the manuals shall include the following information:

(1) Touch screen operation (human machine interface)
(2) Touch screen maintenance (i.e. calibration)

77-1.16 SYSTEM WARRANTY

A. All new equipment shall be warranted against defects in workmanship, hardware and software for a period of twelve (12) month after substantial completion of the project.

77-1.17 SPARE PARTS

A. A recommended spare parts list shall be included with the Submittal including part numbers and pricing. These prices shall be valid for (12) months from date of substantial completion.

77- 2 EQUIPMENT AND MATERIALS

77-2.1 GENERAL

New equipment and new material included in the allowance for the modifications to the existing ALCMS shall match the existing equipment and material.

77- 3 METHOD OF MEASUREMENT

77-3.1 The modification work of the existing ALCMS shall be measured as a lump sum item, which will include all hardware, software, calibration, testing, commissioning, training, operations and maintenance manuals and all other incidental items for a complete operational system. The payment shall be made out of an allowance stipulated in the "Schedule of Work and Prices" as a part of the Bid Package. Payment shall be made based on Contractor's invoice including actual labor and material expended. Any and all unused portions of the allowance shall not be paid to the Contractor.

77-3.2 Fiber optic cable, of the types and sizes indicated, as required to complete the work shown on the plans and described in this section will be measured for payment at the contract price per linear foot, measured in place.

77-3.3 Fiber optic inner duct, of the types and sizes indicated, as required to complete the work shown on the plans and described in this section will be measured for payment at the contract price per linear foot, measured in place.

77-3.4 Measurement and payment for pullboxes and manholes as required to complete the work shown on the plans and described in this section will be made under Section 56 of these Specifications, Section 56-Airport Electrical Underground Duct, Pullboxes and Manholes (FAA-L-110).

77-3.5 Measurement for cutting and splicing of all cables as required to complete the work shown on the plans and described in this section will be as one complete lump sum item, including as required by the plans to complete the work.

77-3.6 Trenching, backfilling, cable connection, testing, agency coordination and other miscellaneous work as required by the plans complete the work shall not be measured for payment but will be considered incidental to other pay items and no separate payment will be made.

77- 4 BASIS OF PAYMENT

77-4.1 Payment for the modifications to the existing ALCMS shall be paid from the allowance stated in the "Schedule of Work and Prices". This price shall be full compensation for furnishing all materials, labor, equipment, supervision, tools and incidental necessary to complete the ALCMS modification work. The Contractor will be compensated under this allowance item as stipulated in Section 9-4 of these specifications.

77-4.2 Payment for 12SM/12MM Fiber Optic Cable will be made at the contract unit price per linear foot. This price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the item.

77-4.3 Payment for Inner Duct will be made at the contract unit price per linear foot for inner duct of the sizes and types indicated. This price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the item.

77-4.4 Payment for cutting and splicing of all cables required to complete the work under this section will be paid at the contract lump sum price. This price shall be full compensation for furnishing all labor, equipment, tools and incidentals necessary to complete the item.

77-4.5 Trenching, backfilling, cable connection, testing, agency coordination, relocating existing ALCMS equipment and other miscellaneous work as required by the plans to complete the work shall not be measured for payment but will be considered incidental to other pay items and no separate payment will be made.

No additional payment will be made for difficulties encountered when accomplishing work under this section in areas of restricted work periods, night construction, or in other areas subject to construction phasing or agency coordination restrictions.

Payment will be made under:

Item 77.1	Modifications to ALCMS	per allowance
Item 77.2	12SM/12MM Fiber Optic Cable	per linear foot
Item 77.3	1" Inner Duct	per linear foot
Item 77.4	Fiber Optic Cuts and Splices	per lump sum

END OF SECTION 77

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
~~Strikeout text~~ – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

I. DESCRIPTION

A. GENERAL

1. Construction of new fiber optic cables and modifications to the Airport Lighting Control and Monitoring System (ALCMS)

B. BACKGROUND

1. Modifications to be carried out with the participation of Crouse-Hinds Airfield Lighting Product Company

C. QUALIFICATIONS

1. The contractor shall ensure that:

a) Contractor or Sub-contractor is a specialized installation contractor

b) Contractor or Sub-contractor has, within the last year contracted similar work

c) Contractor or sub-contractor has at least 5 years experience

D. SUBMITTAL OF QUALIFICATIONS

1. Contractor shall submit a complete qualifications package

E. PROJECT SCOPE

1. FIBER CUT LAWA ALCMS

a) Agencies involved

1) FAA

2) LAWA IT

3) Airfield Ops

4) LAWA Electric Shop

b) Affected Circuits

1) Airfield Taxiway Lighting Circuits

2) Airfield Runway Lighting Circuits

3) Any additional affected circuits

c) Required Work/Restrictions

1) Perform all new work prior to cutting existing

2) Contractor shall splice existing cables to new bypass cable

3) Contractor shall contact LAWA Inspection

d) Test Points

1) ATCT

2) Airfield Electrical Vault

e) Cable

1) Corning Cable Systems ALTOS® LST™ 12 fiber cable

2. ALCMS Scope of Work

a) Existing Airfield Lighting Vaults contain CCRs

b) Graphic displays shall be modified to include the changes

c) All Digitrac/Megatrac control cabinets shall be re-calibrated to accommodate changes

d) Work also includes software, programming, calibration, etc.

3. FIBER OPTIC INSTALLATION EQUIPMENT SPECIFICATIONS

a) Stripping Tools

1) Stripping methods and materials shall not damage fiber optics

2) Fixed fiber diameter tools

3) Variable fiber diameter tools

b) Cleaving Tools

1) Fiber cleaving tools shall allow a clean cleave

2) A precision fiber cleaver

3) Capable of allowing the operator to control the strip length

4) Alcoa AFL CT-20 Fiber Cleaver or equal

c) Splicing Tools

1) Fusion splicer shall have the following specifications:

i. Core-to-core fiber PAS

ii. Full automatic operation

iii. 2 CCD cameras, no up-down mirror

iv. High resolution LCD monitor

v. Simultaneous X & Y axes observation

vi. Automatic arc calibration

vii. Automatic fiber type identifier

viii. 0.02dB with SM fiber

ix. 0.01dB with MM fiber

2) Alcoa Fujikura FSM-40S Splicer or equal

d) Inner Duct

3) for fiber optic cable are to be of the corrugated type

4) Inner duct shall have measured mule tape inside, 1” in size

4. ALCMS Fiber

a) Shall be Corning Cable Systems ALTOS® LST™ 12 fiber cable

5. Fiber Optic Splice Case

a) Preform Line Products Coyote Runt closure

5) Preform Line Products Coyote 12 fiber splice trays

6) Preform Line Products Runt Manhole Support Kits

F. INSTALLATION METHOD OF CABLES

1. All rack steps will have rack clips

2. At every 1300’ interval 50’ of slack shall be anchored on side of pull box

3. FAA fiber optic cable may travel in the same duct bank FAA power cable

G. INSTALLATION OF DUCT OR CONDUIT

1. Inner duct coupling

2. Magnetic caution tape

H. CABLE CUT OVERS

1. Cable cuts must be coordinated

I. FIBER OPTIC CABLE TERMINATIONS

1. Contractor shall only fusion-splice pigtails
2. ST pre-connectorized, pre-terminated, pigtails
3. Fiber optic cable used shall have similar optical characteristics
4. Mechanical splices are not permitted
5. Contractor shall protect all fusion splices

J. TESTING

1. Working Fibers shall be verified
2. Vacant fibers shall be OTDR tested

K. OTHER REFERENCED SPECS

1. Sections 71 and 72

L. PROJECT COORDINATION

1. Manufacturer shall provide an experienced technician
2. ALCMS modification work requires scheduling
3. Contractor shall furnish a schedule

M. INSTALLATION AND COMMISSIONING

1. Contractor shall be responsible for the physical installation
2. Manufacturer shall perform:
    a) Verify Contractor connections
    b) Hardware calibrations
    c) System testing
    d) System Acceptance

N. SYSTEM ACCEPTANCE TEST (SAT)

1. Detailed test plan shall be submitted
2. Manufacturer shall perform on-site a demonstration:
    a) Control functions
    b) Monitoring functions

c) Surveillance functions

d) Alarm functions

e) Print functions

f) Display functions

3. System must complete (1) week of operation

O. AS-BUILT DRAWINGS

1. Contractor shall provide updated as-built drawings

P. OPERATION AND MAINTENANCE MANUALS

1. Manufacturer shall provide instruction manuals

a) Operational overview

b) Logic and block diagrams

c) GUI Screen operation

d) User configuration

e) System Block Diagram

f) Drawings and data sheets

g) Detailed wiring diagrams

h) Detailed assembly drawings

i) (OEM) Manuals

2. Manufacturer shall provide operation manuals

a) Touch screen operation

b) Touch screen maintenance

Q. SYSTEM WARRENTY

1. All new equipment shall be warranted (12) months

R. SPARE PARTS

1. A spare parts list shall be included

II. EQUIPMENT AND MATERIALS

A. GENERAL

1. New equipment and new material shall match the existing equipment and material

III. METHOD OF MEASUREMENT

A. Modification of the existing ALCMS shall be measured as a lump sum

B. Fiber optic cable, will be measured at the contract price per linear foot

C. Fiber optic inner duct, will be measured at the contract price per linear foot

D. Pullboxes and manholes will be made under Section 56

E. Cutting and splicing of all cables will be a lump sum item

F. Trenching, backfilling, cable connection, testing will be considered incidental

IV. BASIS OF PAYMENT

A. Modifications to the existing ALCMS shall be paid from the allowance

B. Payment for Fiber Optic Cable will be made at the contract unit price

C. Payment for Inner Duct will be made at the contract unit price

D. Payment for cutting and splicing will be paid at the contract lump sum price

E. Trenching, backfilling, cable connection, testing shall not be measured for payment

F. Payment will be made under:

Item 77.1 Modifications to ALCMS ..... per allowance

Item 77.2 12SM/12MM Fiber Optic Cable .....per linear foot

Item 77.3 1" Inner Duct .....per linear foot

Item 77.4 Fiber Optic Cuts and Splices ..... per lump sum

END OF SECTION 77