# FAA TECHNICAL SPECIFICATIONS

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Part 1 – General Provisions

Section 10 Definition of Terms

Whenever the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be interpreted as follows:

10-01 AASHTO. The American Association of State Highway and Transportation Officials, the successor association to AASHO.

10-02 Access road. The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.

10-03 Advertisement. A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.

10-04 Airport Improvement Program (AIP). A grant-in-aid program, administered by the Federal Aviation Administration (FAA).

10-05 Air operations area (AOA). For the purpose of these specifications, the term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.

10-06 Airport. Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights-of-way; and airport buildings and facilities located in any of these areas, and includes a heliport.

10-06A Airport Operations. City staff authorized by the Airport to represent the Airport on Airport operational issues.


10-08 Award. The Owner’s notice to the successful bidder of the acceptance of the submitted bid.

10-09 Bidder. Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.

10-10 Building area. An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.

10-11 Calendar day. Every day shown on the calendar.

10-12 Change order. A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the work affected by such changes. The work, covered by a change order, must be within the scope of the contract.
10-13 Contract. The written agreement covering the work to be performed. The awarded contract shall include, but is not limited to: Advertisement, Contract Form, Proposal, Performance Bond, Payment Bond, any required insurance certificates, Specifications, Plans, and any addenda issued to bidders.

10-14 Contract item (pay item). A specific unit of work for which a price is provided in the contract.

10-15 Contract time. The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.

10-16 Contractor. The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.

10-16A Contractor's Expense. When “Contractor’s expense”, “at the expense of the Contractor”, or similar phrases are used, it shall be deemed to mean the “Contractor’s sole expense”, “at the sole expense of the Contractor”, etc., and the City will not reimburse the Contractor or pay for any portion of such expense.

10-17 Contractor’s laboratory. The Contractor’s quality control organization in accordance with the Contractor Quality Control Program.

10-18 Construction Safety and Phasing Plan (CSPP). The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator’s consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.

10-19 Drainage system. The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

10-20 Engineer. The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering observation of the contract work and acting directly or through an authorized representative.

10-21 Equipment. All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

10-22 Extra work. An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Engineer to be necessary to complete the work within the intended scope of the contract as previously modified.

10-23 FAA. The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his or her duly authorized representative.


10-25 Force account. Force account work is planning, engineering, or construction work done by the Sponsor’s employees.

10-26 Inspector. An authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.

10-27 Intention of terms. Whenever, in these specifications or on the plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of like import are used, it shall
be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Owner.

“Approved by the Engineer”, or “acceptable to the Engineer” shall mean that the Engineer has reviewed a Contractor submittal for general conformance to the Plans and Specifications, and compatibility with the design concept of the completed Work as a functioning whole in the Plans and Specifications. Such approvals shall not extend to the Contractor’s means, methods, techniques, equipment and usage, sequences, schedules, or procedures of construction or to related safety precautions and programs.

Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.

10-28 Laboratory. The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer. Also referred to as “Engineer’s Laboratory” or “quality assurance laboratory.”

10-29 Lighting. A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.

10-30 Major and minor contract items. A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.


10-32 Notice to Proceed (NTP). A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.

10-33 Owner. The term “Owner” shall mean the party of the first part or the contracting agency signatory to the contract. Where the term “Owner” is capitalized in this document, it shall mean airport Sponsor only.

10-34 Passenger Facility Charge (PFC). Per 14 CFR Part 158 and 49 USC § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.”

10-35 Pavement. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-36 Payment bond. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.

10-37 Performance bond. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.

10-38 Plans. The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.

10-39 Project. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-40 Proposal. The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.

10-41 Proposal guaranty. The security furnished with a proposal to guarantee that the bidder will enter into a contract if his or her proposal is accepted by the Owner.

10-42 Runway. The area on the airport prepared for the landing and takeoff of aircraft.

10-42A Runway Safety Area (RSA). A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The RSA is: cleared and graded and have no potentially hazardous ruts, bumps depressions, or other surface variations; drained by grading or storm sewers to prevent water accumulation; capable, under dry conditions, of supporting aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; free of objects, except for objects that need to be located in the RSA 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.

10-43 Specifications. A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.


10-44 Sponsor. A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.

10-45 Structures. Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.

10-46 Subgrade. The soil that forms the pavement foundation.

10-47 Superintendent. The Contractor’s executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the Engineer, and who shall supervise and direct the construction.

10-48 Supplemental agreement. A written agreement between the Contractor and the Owner covering (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25%, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.

10-49 Surety. The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.
10-50 Taxiway. For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport’s runways, aircraft parking areas, and terminal areas.

10-50A Taxiway Safety Area (TSA). A defined surface along the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. The TSA is: cleared and graded and have no potentially hazardous ruts, bumps depressions, or other surface variations; drained by grading or storm sewers to prevent water accumulation; capable, under dry conditions, of supporting aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; free of objects, except for objects that need to be located in the TSA 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.

10-51 Work. The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor’s performance of all duties and obligations imposed by the contract, plans, and specifications.

10-52 Working day. A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor’s control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor’s forces engage in regular work will be considered as working days.

END OF SECTION 10
Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders).

The Owner has published the advertisement at such places and at such times as are required by local law or ordinances. The published advertisement states the time and place for submitting sealed proposals; a description of the proposed work; instructions to bidders as to obtaining proposal forms, plans, and specifications; proposal guaranty required; and the Owner's right to reject any and all bids.

20-02 Qualification of bidders. Each bidder shall furnish the Owner satisfactory evidence of his or her competency to perform the proposed work. Such evidence of competency, unless otherwise specified, shall consist of statements covering the bidder’s past experience on similar work, a list of equipment that would be available for the work, and a list of key personnel that would be available. In addition, each bidder shall furnish the Owner satisfactory evidence of his or her financial responsibility. Such evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder’s financial resources and liabilities as of the last calendar year or the bidder’s last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether his or her financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder’s financial responsibility has changed, the bidder shall qualify the public accountant’s statement or report to reflect the bidder’s true financial condition at the time such qualified statement or report is submitted to the Owner.

Each bidder shall submit “evidence of competency” and “evidence of financial responsibility” to the Owner at the time of bid opening.

20-03 Contents of proposal forms. The Owner shall furnish bidders with proposal forms. All papers bound with or attached to the proposal forms are necessary parts and must not be detached.

The plans, specifications, and other documents designated in the proposal form shall be considered a part of the proposal whether attached or not.

20-04 Issuance of proposal forms. The Owner reserves the right to refuse to issue a proposal form to a prospective bidder should such bidder be in default for any of the following reasons:

a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.

c. Documented record of Contractor default under previous contracts with the Owner.

d. Documented record of unsatisfactory work on previous contracts with the Owner.

20-05 Interpretation of estimated proposal quantities. An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception.
because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as hereinafter provided in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 without in any way invalidating the unit bid prices.

Mobilization/Demobilization shall be measured and paid for under Specification Item P-100.

Development and implementation of the Contractor’s “Safety Plan Compliance Document” shall be measured and paid for under Specification Item P-148.

20-06 Examination of plans, specifications, and site. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves as to the character, quality, and quantities of work to be performed, materials to be furnished, and as to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and is satisfied as to the conditions to be encountered in performing the work and as to the requirements of the proposed contract, plans, and specifications.

Boring logs and other records of subsurface investigations and tests are available for inspection of bidders. It is understood and agreed that such subsurface information, whether included in the plans, specifications, or otherwise made available to the bidder, was obtained and is intended for the Owner’s design and estimating purposes only. Such information has been made available for the convenience of all bidders. It is further understood and agreed that each bidder is solely responsible for all assumptions, deductions, or conclusions which the bidder may make or obtain from his or her examination of the boring logs and other records of subsurface investigations and tests that are furnished by the Owner.

20-07 Preparation of proposal. The bidder shall submit his or her proposal on the forms furnished by the Owner. All blank spaces in the proposal forms must be correctly filled in where indicated for each and every item for which a quantity is given. The bidder shall state the price (written in ink or typed) both in words and numerals for which they propose to do for each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall sign the proposal correctly and in ink. If the proposal is made by an individual, his or her name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state under the laws of which the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of his or her authority to do so and that the signature is binding upon the firm or corporation.

20-08 Responsive and responsible bidder. A responsive bid conforms to all significant terms and conditions contained in the Sponsor’s invitation for bid. It is the Sponsor’s responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 49 CFR § 18.36(b)(8). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

20-09 Irregular proposals. Proposals shall be considered irregular for the following reasons:

a. If the proposal is on a form other than that furnished by the Owner, or if the Owner’s form is altered, or if any part of the proposal form is detached.

b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.
c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.

d. If the proposal contains unit prices that are obviously unbalanced.

e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

The definition of responsive and responsible bid shall be as defined in Federal Acquisition Regulation (FAR) 2005-32 Subpart 14.301 Responsiveness of bids, and Subpart 9.104-1 General standards, respectively.

20-10 Bid guarantee. Each separate proposal shall be accompanied by a certified check, bond, or other specified acceptable collateral, in the amount specified in the proposal form. Such check, or collateral, shall be made payable to the Owner. The Surety on the Proposal Bond shall be a corporate Surety authorized under the laws of the State of California to do business in California and to write that type of bond through a resident agent of the corporation.

20-11 Delivery of proposal. Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the bidder on the outside. When sent by mail, preferably registered, the sealed proposal, marked as indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the advertisement or as modified by Addendum before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

20-12 Withdrawal or revision of proposals. A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder’s request for withdrawal is received by the Owner in writing or by fax before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

20-13 Public opening of proposals. Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

20-14 Disqualification of bidders. A bidder shall be considered disqualified for any of the following reasons:

a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

c. If the bidder is considered to be in “default” for any reason specified in the subsection 20-04 titled ISSUANCE OF PROPOSAL FORMS of this section.

20-14 Subcontractors. Bidders shall submit a list of subcontractors as required in the Instruction to Bidders and Proposal form. Failure to submit such list may cause the Bid to be rejected as non-responsive.
20-15 Information Provided During The Bid Period. The bidder may, prior to bid opening, request in writing from the Engineer clarification of the Plans and Specifications. If the Engineer, in the Engineer’s sole discretion, believes there is a need for clarification, the Engineer will issue an Addendum to all prospective bidders. No verbal requests will be honored. No verbal clarifications can be given but, if any verbal statements are made by any Owner employee, the bidder acknowledges by submitting a Bid that said employee had no authority to make such statement and warrants that the bidder did not rely on such statements.

END OF SECTION 20
Section 30 Award and Execution of Contract

30-01 Consideration of proposals. After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a bidder’s proposal contains a discrepancy between unit bid prices and the extended bid prices, the unit price shall govern.

Until the award of a contract is made, the Owner reserves the right to reject a bidder’s proposal for any of the following reasons:

   a. If the proposal is irregular as specified in the subsection 20-09 titled IRREGULAR PROPOSALS of Section 20.

   b. If the bidder is disqualified for any of the reasons specified in the subsection 20-14 titled DISQUALIFICATION OF BIDDERS of Section 20.

In addition, until the award of a contract is made, the Owner reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the Owner’s best interests.

30-02 Award of contract. The award of a contract, if it is to be awarded, shall be made within 120 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

Award of the contract shall be made by the Owner to the lowest, qualified bidder whose proposal conforms to the cited requirements of the Owner.

No award shall be made until the FAA has concurred in the Owner's recommendation to make such award and has approved the Owner's proposed contract to the extent that such concurrence and approval are required by 49 CFR Part 18.

30-03 Cancellation of award. The Owner reserves the right to cancel the award without liability to the bidder, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the Owner in accordance with the subsection 30-07 titled APPROVAL OF CONTRACT of this section.

30-04 Return of proposal guaranty. All proposal guaranties, except those of the two lowest bidders, will be returned immediately after the Owner has made a comparison of bids as specified in the subsection 30-01 titled CONSIDERATION OF PROPOSALS of this section. Proposal guaranties of the two lowest bidders will be retained by the Owner until such time as an award is made, at which time, the unsuccessful bidder’s proposal guaranty will be returned. The successful bidder’s proposal guaranty will be returned as soon as the Owner receives the contract bonds as specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section.

30-05 Requirements of contract bonds. At the time of the execution of the contract, the successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor’s performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.
30-06 Execution of contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety bond or bonds specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section, within 15 calendar days from the date mailed or otherwise delivered to the successful bidder.

The contractor, sub-recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of Department of Transportation (DOT) assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate.

30-07 Approval of contract. Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the Owner shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the Owner’s approval to be bound by the successful bidder’s proposal and the terms of the contract.

30-08 Failure to execute contract. Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the 15 calendar day period specified in the subsection 30-06 titled EXECUTION OF CONTRACT of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidation of damages to the Owner.

END OF SECTION 30
Section 40 Scope of Work

40-01 Intent of contract. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

All labor, materials, tools, equipment and services shall be furnished and work performed and completed subject to the approval of the Owner or its authorized representatives.

All taxes of any nature whatsoever shall be included in the overall cost of the Project. The Contractor shall be prohibited from making any further claims for taxes.

The Contractor shall carefully study and compare all plans, drawings, details and specifications and other instructions and shall at once report any error, inconsistency or omission which Contractor or as subcontractor may discover. While it is believed that much of the information pertaining to conditions which may affect the cost of the work will be shown on the Plans, Drawings, Details or indicated in the Specifications. The Owner does not warrant the completeness or the accuracy of such information. The Contractor shall ascertain the existence of any conditions affecting the cost of the work that would have been disclosed by reasonable examination of the site.

The Contractor shall be liable to the Owner for any damage resulting from any errors or deficiencies in the Contract Documents or instructions furnished by the Owner or its Agent if said errors or deficiencies were or could have been discoverable by reasonable inspection prior to the commencement of construction.

40-02 Alteration of work and quantities. The Owner reserves and shall have the right to make such alterations in the work as may be necessary or desirable to complete the work originally intended in an acceptable manner. Unless otherwise specified herein, the Engineer shall be and is hereby authorized to make such alterations in the work as may increase or decrease the originally awarded contract items and quantities, provided that the aggregate of such alterations does not change the total cost of any major contract item by more than 25% (total cost being based on the unit prices and estimated quantities in the awarded contract). Alterations that do not exceed the 25% limitation shall not invalidate the contract nor release the surety, and the Contractor agrees to accept payment for such alterations as if the altered work had been a part of the original contract. These alterations that are for work within the general scope of the contract shall be covered by “Change Orders” issued by the Engineer. Change orders for altered work shall include extensions of contract time where, in the Engineer’s opinion, such extensions are commensurate with the amount and difficulty of added work.

Should the aggregate amount of altered work exceed the 25% limitation hereinbefore specified, such excess altered work shall be covered by supplemental agreement. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

Supplemental agreements shall be approved by the FAA and shall include all applicable Federal contract provisions for procurement and contracting required under AIP. Supplemental agreements shall also require consent of the Contractor’s surety and separate performance and payment bonds.

All supplemental agreements shall be approved by the FAA and shall include valid wage determinations of the U.S. Secretary of Labor when the amount of the supplemental agreement exceeds $2,000.
However, if the Contractor elects to waive the limitations on work that increases or decreases the 
originally awarded major Contract item by more than 25 percent, the supplemental agreement shall be 
subject to the same U.S. Secretary of Labor wage determination as was included in the originally awarded 
Contract. All supplemental agreements shall require consent of the Contractor's surety and separate 
performance and payment bonds.

**40-03 Omitted items.** The Engineer may, in the Owner’s best interest, omit from the work any contract 
item, except major contract items. Major contract items may be omitted by a supplemental agreement. 
Such omission of contract items shall not invalidate any other contract provision or requirement. 

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid 
for all work performed toward completion of such item prior to the date of the order to omit such item. 
Payment for work performed shall be in accordance with the subsection 90-04 titled PAYMENT FOR 
OMITTED ITEMS of Section 90.

**40-04 Extra work.** Should acceptable completion of the contract require the Contractor to perform an 
item of work for which no basis of payment has been provided in the original contract or previously 
issued change orders or supplemental agreements, the same shall be called “Extra Work.” Extra Work 
that is within the general scope of the contract shall be covered by written change order. Change orders 
for such Extra Work shall contain agreed unit prices for performing the change order work in accordance 
with the requirements specified in the order, and shall contain any adjustment to the contract time that, in 
the Engineer’s opinion, is necessary for completion of such Extra Work.

When determined by the Engineer to be in the Owner’s best interest, the Engineer may order the 
Contractor to proceed with Extra Work as provided in the subsection 90-05 titled PAYMENT FOR 
EXTRA WORK of Section 90. Extra Work that is necessary for acceptable completion of the project, but 
is not within the general scope of the work covered by the original contract shall be covered by a 
Supplemental Agreement as defined in the subsection 10-48 titled SUPPLEMENTAL AGREEMENT of 
Section 10.

Any claim for payment of Extra Work that is not covered by written agreement (change order or 
supplemental agreement) shall be rejected by the Owner.

**40-05 Maintenance of traffic.** It is the explicit intention of the contract that the safety of aircraft, as well 
as the Contractor’s equipment and personnel, is the most important consideration.

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed 
movement of aircraft in the air operations areas (AOAs) of the airport with respect to his or her own 
operations and the operations of all subcontractors as specified in the subsection 80-04 titled 
LIMITATION OF OPERATIONS of Section 80. It is further understood and agreed that the Contractor 
shall provide for the uninterrupted operation of visual and electronic signals (including power supplies 
thereof) used in the guidance of aircraft while operating to, from, and upon the airport as specified in the 
subsection 70-15 titled CONTRACTOR’S RESPONSIBILITY FOR UTILITY SERVICE AND 
FACILITIES OF OTHERS in Section 70.

Ducts, cable, electrical, and paving work shall be accomplished with special care and recognition of 
the importance of avoiding the disruption of air traffic control functions. Unless otherwise approved in 
writing, any work in conjunction with or adjacent to cable and duct systems shall be done only in the 
presence of, and pursuant to a schedule satisfactory to, an authorized representative of the FAA.

b. With respect to his or her own operations and the operations of all subcontractors, the Contractor 
shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, 
storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-
rescue equipment, or maintenance vehicles at the airport.
When the contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor’s performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall be responsible for the repair of any damage caused by the Contractor’s equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (http://mutcd.fhwa.dot.gov/), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

**40-06 Removal of existing structures.** All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Engineer shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the Engineer in accordance with the provisions of the contract.

Except as provided in the subsection 40-07 titled RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK of this section, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

**40-07 Rights in and use of materials found in the work.** Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be either embankment or waste, the Contractor may at his or her option either:

- **a.** Use such material in another contract item, providing such use is approved by the Engineer and is in conformance with the contract specifications applicable to such use; or,
- **b.** Remove such material from the site, upon written approval of the Engineer; or
- **c.** Use such material for the Contractor’s own temporary construction on site; or,
- **d.** Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the Engineer’s approval in advance of such use.

Should the Engineer approve the Contractor’s request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at his or her own expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the Engineer approve the Contractor’s exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.
It is understood and agreed that the Contractor shall make no claim for delays by reason of his or her exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 Final cleanup. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of such property Owner.

40-09 Contractor Key Personnel. The Contractor shall employ competent Superintendent(s) and necessary assistants who shall be in attendance at the Project site during the progress of the work. The Superintendent(s) shall be satisfactory to the Owner, and shall not be changed except with the written consent of the Owner, unless a Superintendent proves to be unsatisfactory to the Contractor or ceases to be in his employ. The Contractor shall identify the key personnel he intends to assign to the Project prior to execution of the Contract. The Owner reserves the right to approve/disapprove the Contractor’s proposed key personnel.

The Superintendent shall represent the Contractor and all written communications given to the Superintendent(s) shall be as binding as if given to the Contractor. In addition to the Superintendent(s), the Contractor’s Project Manager or other representative on site shall have the authority to accept instructions from the Engineer.

A duly authorized representative of the Contractor shall be available for emergency telephone communications from the Owner or Engineer on a 24-hour basis, seven (7) days a week during the performance of the work.

Nothing contained in this Contract shall create any Contractual relations between the Owner and subcontractor. Except as otherwise specifically provided herein under warranties, the Contractor shall not be an agent for the Owner.

END OF SECTION 40
50-01 Authority of the Engineer. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, and as to the manner of performance and rate of progress of the work. The Engineer shall decide all questions that may arise as to the interpretation of the specifications or plans relating to the work. The Engineer shall determine the amount and quality of the several kinds of work performed and materials furnished which are to be paid for under contract.

The Engineer does not have the authority to accept pavements that do not conform to FAA specification requirements.

50-02 Conformity with plans and specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans or specifications.

If the Engineer finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications but that the portion of the work affected will, in his or her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the Engineer will advise the Owner of his or her determination that the affected work be accepted and remain in place. In this event, the Engineer will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. The Engineer’s determination and recommended contract price adjustments will be based on sound engineering judgment and such tests or retests of the affected work as are, in the Engineer’s opinion, needed. Changes in the contract price shall be covered by contract change order or supplemental agreement as applicable.

If the Engineer finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the Engineer’s written orders.

For the purpose of this subsection, the term “reasonably close conformity” shall not be construed as waiving the Contractor’s responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the Engineer’s responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor’s execution of the work, when, in the Engineer’s opinion, such compliance is essential to provide an acceptable finished portion of the work.

For the purpose of this subsection, the term “reasonably close conformity” is also intended to provide the Engineer with the authority, after consultation with the FAA, to use sound engineering judgment in his or her determinations as to acceptance of work that is not in strict conformity, but will provide a finished product equal to or better than that intended by the requirements of the contract, plans and specifications. The Engineer will not be responsible for the Contractor’s means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 Coordination of contract, plans, and specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and
provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the Engineer for an interpretation and decision, and such decision shall be final.

**LIST OF SPECIAL PROVISIONS**

In case of a discrepancy between the Plans and the Specifications, the following is the order of precedence of the Contract Documents:

1. Signed Addendum
2. Executed and signed, written Agreement
3. FAA Technical Specifications Parts 2 through 11 inclusive
4. FAA Technical Specifications Part 1
5. Project Plans
6. Cited FAA Advisory Circulars
7. Cited Standards for Materials and Testing
8. Section 14 of the Special Provisions
9. All other sections of the Special Provisions
10. City Standard Details
11. City Standard Specifications
12. Caltrans Standard Specifications
13. Caltrans Standard Plans

**50-04 Cooperation of Contractor.** The Contractor will be supplied with five copies each of the plans and specifications. The Contractor shall have available on the work at all times one copy each of the plans and specifications. Additional copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the Engineer and his or her inspectors and with other contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as his or her agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the Engineer or his or her authorized representative.

**50-05 Cooperation between contractors.** The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work so as not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.
Each Contractor involved shall assume all liability, financial or otherwise, in connection with his or her contract and shall protect and save harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange his or her work and shall place and dispose of the materials being used so as not to interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join his or her work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

**50-06 Construction layout and stakes.** The Engineer shall establish horizontal and vertical control only. The Contractor must establish all layout required for the construction of the work. Such stakes and markings as the Engineer may set for either their own or the Contractor’s guidance shall be preserved by the Contractor. In case of negligence on the part of the Contractor, or their employees, resulting in the destruction of such stakes or markings, an amount equal to the cost of replacing the same may be deducted from subsequent estimates due the Contractor at the discretion of the Engineer.

The Contractor will be required to furnish all lines, grades and measurements from the control points necessary for the proper execution and control of the work contracted for under these specifications.

The Contractor must give copies of survey notes to the Engineer for each area of construction and for each placement of material as specified to allow the Engineer to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. All surveys must be provided to the Engineer prior to commencing work items that will cover or disturb the survey staking as set by the Contractor’s surveyor. Survey(s) and notes shall be provided in the following format(s): Survey(s) in AutoCAD® Civil 3D 2013 format and a signed and sealed hardcopy; survey notes in Adobe Acrobat pdf format. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.

Payment will be made under P-110-3.2, unless otherwise specified in contract documents, for this labor, materials, or other expenses.

Prior to setting any construction stakes, the Contractor shall first verify the accuracy of the control points established by the Engineer as shown on the Plans. If errors are discovered during this verification process, and the control points do not agree with the geometry or elevation shown in the Plans, the Contractor shall immediately notify the Engineer in writing, explaining the issue in detail. The Engineer will advise the Contractor within five (5) working days of any corrective actions, which may be deemed necessary. Secondly, upon completion of this verification process, the Contractor’s registered Land Surveyor shall certify in writing, that all control points established by the Engineer are acceptable and adequate to allow the Contractor’s construction staking to meet the accuracy requirements of the specifications.

Surveys performed by the Contractor shall conform to the California Land Surveyor’s Act. In accordance with the Act, “responsible charge” for surveying shall reside with a licensed land surveyor or a civil engineer qualified to practice land surveying in California.

Construction Staking and Layout includes but is not limited to:

- a. Clearing and Grubbing perimeter staking
- b. Rough Grade slope stakes at 100-foot (30-m) stations
- c. Drainage Swales slope stakes and flow line blue tops at 50-foot (15-m) stations
Subgrade blue tops at 25-foot (7.5-m) stations and 25-foot (7.5-m) offset distance (maximum) for the following section locations:

a. Runway – minimum five (5) per station  
b. Taxiways – minimum three (3) per station  
c. Holding apron areas – minimum three (3) per station  
d. Roadways – minimum three (3) per station

Base Course blue tops at 25-foot (7.5-m) stations and 25-foot (7.5-m) offset distance (maximum) for the following section locations:

a. Runway – minimum five (5) per station  
b. Taxiways – minimum three (3) per station  
c. Holding apron areas – minimum three (3) per station

Pavement areas:

a. Edge of Pavement hubs and tacks (for stringline by Contractor) at 100-foot (30-m) stations.  
b. Between Lifts at 25-foot (7.5-m) stations for the following section locations:
   (1) Runways – each paving lane width  
   (2) Taxiways – each paving lane width  
   (3) Holding areas – each paving lane width  
c. After finish paving operations at 50-foot (15-m) stations:
   (1) All paved areas – Edge of each paving lane prior to next paving lot  
d. Shoulder and safety area blue tops at 50-foot (15-m) stations and at all break points with maximum of 50-foot (15-m) offsets.  
e. Fence lines at 100-foot (30-m) stations minimum and all change of directions.  
f. Electrical and Communications System locations, lines and grades including but not limited to duct runs, connections, fixtures, signs, lights, Visual Approach Slope Indicators (VASIs), Precision Approach Path Indicators (PAPIs), Runway End Identifier Lighting (REIL), Wind Cones, Distance Markers (signs), pull boxes and manholes.  
g. Drain lines, cut stakes and alignment on 25-foot (7.5-m) stations, inlet and manholes.  
h. Painting and Striping layout (pinned with 1.5 inch PK nails) marked for paint Contractor. (All nails shall be removed after painting).  
i. Laser, or other automatic control devices, shall be checked with temporary control point or grade hub at a minimum of once per 400 feet (120 m) per pass (that is, paving lane).

The establishment of Survey Control and/or reestablishment of survey control shall be by a licensed land surveyor or a civil engineer qualified to practice land surveying in California.

Controls and stakes disturbed or suspect of having been disturbed shall be checked and/or reset as directed by the Engineer without additional cost to the Owner.

50-07 Automatically controlled equipment. Whenever batching or mixing plant equipment is required to be operated automatically under the contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for a period 48 hours following the
breakdown or malfunction, provided this method of operations will produce results which conform to all other requirements of the contract.

50-08 Authority and duties of inspectors. Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. Inspectors are not authorized to revoke, alter, or waive any provision of the contract. Inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

Inspectors are authorized to notify the Contractor or his or her representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the Engineer for a decision.

50-09 Inspection of the work. All materials and each part or detail of the work including all quality control testing, shall be subject to inspection. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor’s sole expense.

Any work done or materials used without supervision or inspection by an authorized representative of the Owner may be ordered removed and replaced at the Contractor’s sole expense unless the Owner’s representative failed to inspect after having been given reasonable notice in writing that the work was to be performed.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 Removal of unacceptable and unauthorized work. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the Engineer as provided in the subsection 50-02 titled CONFORMITY WITH PLANS AND SPECIFICATIONS of this section.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of the subsection 70-14 titled CONTRACTOR’S RESPONSIBILITY FOR WORK of Section 70.

No removal work made under provision of this subsection shall be done without lines and grades having been established by the Engineer. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans or as established by the Engineer, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor’s expense.

Upon failure on the part of the Contractor to comply with any order of the Engineer made under the provisions of this subsection, the Engineer will have authority to cause unacceptable work to be remedied.
or removed and replaced and unauthorized work to be removed and to deduct the costs incurred by the Owner from any monies due or to become due the Contractor.

50-11 Load restrictions. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor shall be responsible for all damage done by his or her hauling equipment and shall correct such damage at his or her own expense.

50-12 Maintenance during construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

Throughout all Phases and Schedules of the construction, including suspension of the Work, and until final acceptance of the Work, the Contractor shall keep the work site clean and free from rubbish and debris. The Contractor shall also abate dust by cleaning, vacuum sweeping, and sprinkling with water, or other means as directed by the Engineer or Airport Operations.

All construction equipment not being used shall be stored and parked in the Contractor's yard or in the staging areas.

Materials and equipment shall be removed from the site as soon as they are no longer necessary; and, upon completion of the Work and before final inspection, the entire Work site shall be cleared of equipment, unused materials, and rubbish so as to present a satisfactory clean and neat appearance.

Care shall be taken to prevent spillage on haul routes. Any such spillage shall be removed immediately and the area cleaned.

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in the subsection 50-12 titled MAINTENANCE DURING CONSTRUCTION of this section, the Engineer shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the Engineer’s notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be deducted from monies due or to become due the Contractor.

50-14 Partial acceptance. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the Engineer to make final inspection of that unit. If the Engineer finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the Engineer
may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-14A Substantial Completion. Substantial completion is the stage in the progress of the work when all of the work is complete in accordance with the Plans and Specifications so the Owner can occupy or utilize the project for its intended use. For the Work to be substantially complete, the following items must be completed in accordance with the Plans and Specifications; grading, drainage, hydroseeding, fencing, all utilities, milling and paving, shoulder paving, edge lighting, permanent paint marking, and the installation of the directional signs. The purpose of granting or acknowledging substantial completion is to stop Contract time or to permit the work to progress to a subsequent Schedule. Granting of substantial completion will eliminate the possibility of incurring liquidated damages or additional liquidated damages beyond the substantial completion date, whichever case may apply. The date of substantial completion shall be the date the Engineer receives, in writing, notification from the Contractor, that the Work is substantially complete. If upon inspection the Work Engineer determines that the Work is not substantially complete and/or not ready for inspection, the date of notification from the Contractor will become void. In the event that the Engineer grants substantial completion, the Contractor shall have thirty (30) calendar days thereafter to complete punch list work, unless additional time is granted in writing by the Engineer. In no case shall a Contractor be granted more than thirty (30) calendar days to complete punch list work, unless there are extenuating circumstances such as a labor strike or circumstance beyond the Contractor's control that would necessitate a further time extension.

In the event the Contractor fails to complete the punch list work within thirty (30) calendar days following the substantial completion date, or in the case of specialized situations within the additional time allotted by the Engineer, the Contractor may be declared in default, and the Engineer may order the Work completed by others. In the event of default, as described herein, the Engineer shall withhold from the Contractor's final or next partial payment, an amount equal to at least twice the estimated cost of the remaining work. In addition, the Engineer shall withhold the retention or securities deducted from Contract progress payments until all punch list work has been satisfactorily completed, whereupon twice the amount of the actual cost of completing the Work shall be deducted from the Contractor's final payment and the remaining funds, if any, including the Contract retention, shall be released in accordance with the conditions set forth in Contract retention.

50-15 Final acceptance. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer and Owner will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and specifications, such inspection shall constitute the final inspection. The Engineer shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of same and the Contractor shall immediately comply with and execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

Contract Retention and Securities: This project shall not be considered complete until all work has been completed, including - punch list work, the submission of the as-built record drawings by the Contractor, and administrative issues defined by the Engineer. The Contractor shall not receive any portion of the legally retained progress payments until the Owner has granted a final acceptance for the entire project or acknowledged substantial completion for the entire project. The following conditions shall apply to each case:
• **Project Acceptance** — Project acceptance implies that all punch list work is complete and the improvements have been accepted by the Owner. Retention will be fully released to the Contractor thirty-five (35) days after the Owner accepts the entire project.

## 50-16 Claims for adjustment and disputes.

a. **Claims for Additional Costs.** If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the Engineer in writing of his or her intention to claim such additional compensation a minimum of twenty-four (24) hours before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the Engineer who will present it to the Owner for consideration in accordance with local laws or ordinances.

b. **Weather Delay.** Extensions of time due to adverse weather conditions not reasonably anticipated will be granted only if such inclement weather prevents the execution of critical path items of the Work at the time of the inclement weather. And extensions of time for weather delays will be considered only if such actual monthly inclement weather exceeds by more than two (2) times the monthly average for the same month recorded over 20 years at the Airport. The extension would be considered on the day after the rainfall exceeds the trigger value. The Contractor shall base his CPM Schedule using at least five (5) weather delay days per month. These weather days will not be considered for an extension of Contract time.

The Contractor shall request in writing an extension of time within forty-eight (48) hours after the event that caused the delay. This written notification is required regardless if the request is based on inclement weather or based on other factors. No extension of time will granted if the written request is not received within forty-eight (48) hours after the event that caused the delay.

c. **Notice of Claim For Additional Time.** If the Contractor wishes to make a claim for an increase in the Contract Time, written notice shall be given. The notice shall be made in writing to the Engineer within five (5) calendar days of the delay causing occurrence except for notice of adverse weather caused delays, which shall be made within forty-eight (48) hours. The notice shall set forth (a) the cause of the delay, (b) a description of the portion or portions of Work affected by the delay, (c) the specific number of days of delay for which an extension of time is requested, (d) all actions the Contractor is taking to mitigate the delay, (e) any actions the City or others could take to mitigate the delay, (f) the latest schedule showing the delayed activity’s relationship to the project’s critical path, and (g) all details pertaining thereto. In the case of a continuing delay, the Contractor shall submit weekly, an updated notice. Failure to give notice of a claim for extension of time in strict compliance with this provision shall constitute a waiver of such claim.

d. **Critical Path.** No extension of time shall be granted to the Contractor for a delay caused by the Owner, Engineer, other contractors or any other party, or other causes beyond the Contractor’s control, unless the delay affects the critical path of the Work as defined on a critical path method schedule or monthly update provided to the Engineer before the delaying occurrence and then only to the extent that the delay affects the critical path. If the delay event forces a previously non-critical path activity onto the project critical path, this change must be shown on the next monthly update and expressly identified in the narrative report. Failure to so identify critical path changes shall be deemed to waive the Contractor’s right to recover any costs associated with the delay event’s impact on the activity. Delays not identified on the Contractor’s next monthly update shall be waived. No extension of time shall be granted to the
Contractor to the extent that, notwithstanding the existence of any such circumstance beyond the Contractor’s control, delay would have resulted in any event due to a concurrent unexcused delay.

**e. Changes In Work.** For changes in the Work that significantly affect the time and progress of the Work, any time extensions shall be requested no later than when the change in the Work is requested. Any change order negotiated and signed by the Contractor and Owner that does not include an express time extension shall be deemed conclusive evidence that no time extensions related to the changed Work is warranted and the Contractor shall forever waive its right to claim entitlement to such a time extension. Change order requests shall include all costs necessary to perform the extra Work within the Contract Period unless a time extension is granted. This shall include but not be limited to necessary acceleration costs. The Contractor may reserve the right to request a time extension at a later date. However, if the Contractor elects to do so, the Engineer will withhold ten (10) percent of the change order amount until the Contractor submits a critical path method schedule analysis that complies with all Contract requirements and identifies the resultant delay. If the Contractor fails to timely do so, the Owner may use the withheld amount to perform a schedule analysis to identify the resulting delay.

**f. Overhead Costs During Time Extensions.** The Contractor and Owner contemplate that the entire contract period may be reasonably necessary to complete this Contract’s scope of work. It is the contemplation of the parties that any home office or field overhead or supervision costs necessary to perform work during the entire contract period is incorporated into the Contractor’s bid and the Contract amount. The Contractor shall not be entitled to recover home office or field overhead and supervision costs during the contract period, even if the Contractor originally planned to complete the work before the contract period expired. Acceptance by the Owner of schedules showing early completion by the Contractor shall not constitute a waiver of this provision.

**g. Out-of-Sequence Work.** The Contractor and Owner may contemplate that changes in the Contractor’s schedule and the performance of out-of-sequence work may be necessary for the beneficial and timely completion of the Work, safety of the flying public or convenience of the Owner. In signing the contract the Contractor expressly waives any claim for additional costs resulting from out-of-sequence work beneficial to the overall Work.

**h. Continuing Contract Performance.** Pending final resolution of a claim, the Contractor shall proceed diligently with performance of the Work and the Owner shall continue to make payments in accordance with the Contract other than amounts in dispute.

**i. Claim Documentation.** Within 5 calendar days after the Contractor submits a notice of claim, the Contractor shall submit a “Claim,” which shall include the following documentation:

   a. The date of the occurrence and the nature and circumstances of the issue for which the notice of claim was given.
   b. The identity of any documents and the substance of any oral communication related to the issue.
   c. The basis for an assertion that the work required is a change from the original contractor work or schedule.
   d. The identity of particular elements of the Work for which a change in compensation and/or time may be sought including:
      a) Pay item(s) that have been or may be affected by the issue and any adjustments to unit price(s) that are required;
      b) Labor and/or materials that will be added, deleted or wasted by the problem and what equipment will be idled or required.
      c) Delay and disruption in the manner and sequence of performance that has been or will be required.
d) Adjustments to delivery schedule(s), staging, and contract time due to the dispute and

e) An estimate of time within which the Owner must respond to the notice to minimize cost, delay, or disruption of issue.

A previously submitted project schedule demonstrating that any affected activities were identified as on the Work’s critical path or were made critical by the delay.

f. Any other items or information germane to the dispute.

g. The Contractor’s written certification under oath as follows:

“I, ____________________________, being the ____________________________ (must be an officer) of ____________________________ (General Contractor), declare under penalty of perjury under the laws of the State of California, and do personally certify and attest that: I have thoroughly reviewed the attached Claim for additional compensation and/or extension of time, and know its contents, and said claim is made in good faith; the supporting data is truthful and accurate; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Monterey Peninsula Airport Owner is liable; and, further, that I am familiar with Federal Acquisition Regulation (FAR) clause 52.214-27, found in 48 CFR Part 52; and further know and understand that submission or certification of a false claim may lead to fines, imprisonment, and/or other severe legal consequences.

By:__________________
Title: ________________
Date: ________________”

If any subcontractor or any lower tier subcontractor wishes to make a Claim, the subcontractor shall also provide the above certification (in addition to the General Contractor).

j. Claims for Consequential Damages. The Contractor waives all claims against the Owner for consequential damages arising out of or relating to this Contract. This waiver includes the Contractor’s principal office expenses including the compensation of personnel stationed there, financing losses, bonding costs, business and reputation losses, and lost profits.

k. Claim Review. Claims shall be submitted to the Engineer, who shall review the Claim and provide a recommendation to the Owner. The Engineer’s recommendation shall not be binding on the Owner. The Owner, may meet with the Contractor to review the claim.

Owner’s Audit Rights. The submission of a Claim by the Contractor shall entitle the Owner, FAA and Engineer to audit all Contractor records and documents relating to the Work, including but not limited to the Contractors bid documents, job cost records and ledgers, payrolls, schedules, all written communications including e-mails with its subcontractor and material suppliers, and subcontract agreements. The Contractor’s failure to timely provide these documents shall constitute a material breach of the Contract. Nothing in this subsection shall be construed as a waiver of the Contractor’s right to dispute final payment based on differences in measurements or computations.

50-17 Cost reduction incentive. The provisions of this subsection will apply only to contracts awarded to the lowest bidder pursuant to competitive bidding.

On projects with original contract amounts in excess of $100,000, the Contractor may submit to the Engineer, in writing, proposals for modifying the plans, specifications or other requirements of the
contract for the sole purpose of reducing the cost of construction. The cost reduction proposal shall not impair, in any manner, the essential functions or characteristics of the project, including but not limited to service life, economy of operation, ease of maintenance, desired appearance, design and safety standards. This provision shall not apply unless the proposal submitted is specifically identified by the Contractor as being presented for consideration as a value engineering proposal.

Not eligible for cost reduction proposals are changes in the basic design of a pavement type, runway and taxiway lighting, visual aids, hydraulic capacity of drainage facilities, or changes in grade or alignment that reduce the geometric standards of the project.

As a minimum, the following information shall be submitted by the Contractor with each proposal:

a. A description of both existing contract requirements for performing the work and the proposed changes, with a discussion of the comparative advantages and disadvantages of each.

b. An itemization of the contract requirements that must be changed if the proposal is adopted.

c. A detailed estimate of the cost of performing the work under the existing contract and under the proposed changes.

d. A statement of the time by which a change order adopting the proposal must be issued.

e. A statement of the effect adoption of the proposal will have on the time for completion of the contract.

f. The contract items of work affected by the proposed changes, including any quantity variation attributable to them.

The Contractor may withdraw, in whole or in part, any cost reduction proposal not accepted by the Engineer, within the period specified in the proposal. The provisions of this subsection shall not be construed to require the Engineer to consider any cost reduction proposal that may be submitted.

The Contractor shall continue to perform the work in accordance with the requirements of the contract until a change order incorporating the cost reduction proposal has been issued. If a change order has not been issued by the date upon which the Contractor’s cost reduction proposal specifies that a decision should be made, or such other date as the Contractor may subsequently have requested in writing, such cost reduction proposal shall be deemed rejected.

The Engineer shall be the sole judge of the acceptability of a cost reduction proposal and of the estimated net savings from the adoption of all or any part of such proposal. In determining the estimated net savings, the Engineer may disregard the contract bid prices if, in the Engineer’s judgment such prices do not represent a fair measure of the value of the work to be performed or deleted.

The Owner may require the Contractor to share in the Owner’s costs of investigating a cost reduction proposal submitted by the Contractor as a condition of considering such proposal. Where such a condition is imposed, the Contractor shall acknowledge acceptance of it in writing. Such acceptance shall constitute full authority for the Owner to deduct the cost of investigating a cost reduction proposal from amounts payable to the Contractor under the contract.

If the Contractor’s cost reduction proposal is accepted in whole or in part, such acceptance will be by a contract change order that shall specifically state that it is executed pursuant to this subsection. Such change order shall incorporate the changes in the plans and specifications which are necessary to permit the cost reduction proposal or such part of it as has been accepted and shall include any conditions upon which the Engineer’s approval is based. The change order shall also set forth the estimated net savings attributable to the cost reduction proposal. The net savings shall be determined as the difference in costs between the original contract costs for the involved work items and the costs occurring as a result of the proposed change. The change order shall also establish the net savings agreed upon and shall provide for
adjustment in the contract price that will divide the net savings equally between the Contractor and the Owner.

The Contractor’s 50% share of the net savings shall constitute full compensation to the Contractor for the cost reduction proposal and the performance of the work.

Acceptance of the cost-reduction proposal and performance of the cost-reduction work shall not extend the time of completion of the contract unless specifically provided for in the contract change order.

50-18 Airport Access And Operations. All access to the Airport and all operations thereon shall be in strict conformance with Airport policies included elsewhere herein, and shall, at all times, be subject to the approval of the Engineer.

Scheduling of work shall be such that aircraft access to open portions of the airfield is provided at all times. The Contractor shall coordinate with the Engineer as to proposed work schedules. The Air Traffic Control Tower (if present at the Airport) must be kept informed of the operations in progress.

Access to the work areas shall be by way of the roadways and haul routes designated on the Plans.

Any damage to access roads as a result of Contractor's operations shall be repaired by the Contractor at the Contractor’s sole expense, and to the full satisfaction of the Engineer.

No Contractor vehicle, equipment or personnel shall cross any active runway, taxiway or apron without being under escort from Airport Operations.

While a runway is open to aircraft operations as a minimum the following restrictions shall apply:

1. No construction may occur within two-hundred and fifty (250) feet of the runway centerline;
2. No construction may occur within the limits of the existing or temporary RSA; and
3. Construction vehicles, equipment and material shall not penetrate the CFR 14 Part 77 Civil Imaginary Surface, and the runway approach and departure surfaces.

While a taxiway is open to aircraft operations the following restrictions shall apply:

1. No construction may occur closer than sixty (60) feet from the taxiway centerline, or at least one-half of the widest wingspan of the aircraft expected to use the taxiway, whichever distance is greater.
2. The Contractor shall maintain adequate clearance between construction equipment and any part of an aircraft. If such clearance can only be maintained if an aircraft does not have full use of the entire taxiway width (with its main landing gear at the edge of the pavement), then it will be necessary to move personnel and equipment for each passing aircraft. In these situations, flag persons will be used to direct construction equipment.

The presence of construction equipment, rough grades, or open excavations in excess of three (3) inches deep within the RSA and TSA will require closure of the subject aircraft operation area. Details on necessary procedures for marking and lighting runway and taxiway closures may be found in the FAA’s Advisory Circular 150/5340-1 (current edition) “Standards for Airport Markings.” Any closure of an operational area shall be requested in writing by the Contractor for review and approval by the Engineer prior to the start of the closure.

Airport operational conditions may require that Contractor's personnel and equipment be temporarily cleared from the vicinity of certain runways and taxiways to permit aircraft operations. In the event such conditions arise, the Contractor shall immediately comply with directives from Airport Operations and the Air Traffic Control Tower if applicable.
50-19 Clean-Up of Construction Area. Unless indicated otherwise, waste material or debris shall be removed by the Contractor each day prior to the opening of the Runways and Taxiways to ensure that it does not create a hazard and as directed by the Engineer. Debris shall not be deposited on any active portion (Runway OFA, Taxiway OFA etc.) of a runway, taxiway, or apron.

a. Waste Materials. All waste materials, including construction debris, shall be collected and stored in a secured metal roll-off container with lid. No construction waste material shall be buried on site. The roll-off container shall be emptied as necessary and the waste materials shall be hauled to a licensed landfill at the Contractor’s expense.

b. Hazardous Waste. At a minimum, any products in the following categories shall be considered hazardous: paint, acids for cleaning masonry surfaces, cleaning solvents, asphalt products, chemical additives for spill stabilization, curing compounds and additives. In the event of a spill that may be hazardous, the Contractor shall take immediate remedial action, and contact the Fire Department.

c. Sanitary Waste. All sanitary waste shall be collected from the construction portable units and the Contractor’s and Engineer’s Field Offices (if applicable) as necessary or as required by a licensed sanitary waste management Contractor. All waste material disposal shall be the responsibility of the Contractor.

50-20 Dust Control. The Contractor shall prevent fugitive dust and shall control dust caused by the Contractor’s operations or from stockpiled material, including during those periods when no construction work is in progress.

Dust control operations shall be performed by the Contractor at its sole expense at the time, location, and in the amount required by the Engineer. No additional compensation shall be made for dust control measures that are deemed necessary by the Engineer.

The Contractor shall, at a minimum, take the following measures to control and prevent dust and to prevent generation of Foreign Object Debris (FOD):

a. To control dust on unpaved roadways, stockpiles and generally around the construction site, all disturbed areas shall be treated, as required or as directed by the Engineer, with approved dust suppressants.

b. Temporary haul roads leading up to the work site shall be stabilized with Aggregate Base Course (ABC).

c. Vacuum type sweeper(s) shall be required on all paved access roads, runways, taxiways, aprons, etc. for dust control. The type shall be Tymco model HSP-600 with high speed power head or Elgin model crosswind vacuum sweeper.

50-21 Record Drawings. One complete set of the Plans, reserved for use as ‘Record Drawings’ shall be kept at the work site at all times by the Contractor. The Contractor shall maintain on these Record Drawings a currently updated record of all construction changes and variations from the Plans, including a) all underground and surface improvements installed in locations other than those indicated on the Plans; b) existing underground facilities uncovered by the work. Said record information shall be entered in red color. Where a Plan does not exist, the Contractor shall submit an accurate and detailed sketch. All changes and variations to the Plans shall be properly dimensioned and located.

The Contractor shall, prior to final acceptance of the Work, furnish the above specified record drawings to the Engineer.

As a minimum, the Contractor shall provide record drawing elevations for each spot grade shown on the Plans, including finished Taxiway pavement, Runway pavement, shoulder pavement, access road pavement, storm drain inverts, grates, storm drain manholes, electrical manholes, electrical handholes and pull boxes, airfield sign foundations and all navigation aids. The Contractor shall provide record stations
and offsets for each handhole, pull box, electrical manhole, light base, light base, storm drain catch basin, storm drain manholes, localizer markers, or other similar structure on the annotated set of record drawings.

**50-22 Interpretation of Plans and Specifications.** The Engineer will interpret the meaning of any part of the Plans and Specifications about which any misunderstanding may arise and the Engineer’s decision will be final.

Should there appear to be any error or discrepancy in or between the Plans and Specifications, the Contractor shall refer the matter to the Engineer for adjustment before proceeding with the Work. Should the Contractor proceed with the Work without so referring the matter, the Contractor does so at its own risk and must bear any additional cost incurred as a result of failure to so refer.

**50-23 Foreign Object Debris (FOD) Prevention.** Aircraft and aircraft engines are susceptible to damage from FOD. Prevention of FOD from debris and waste material lying on and adjacent to airfield pavements is critical. The Contractor shall remove all such materials that may appear on or could migrate to operational aircraft pavements due to the Contractor’s operations. The Contractor shall provide vacuum sweepers of sufficient size and quantity to allow the Contractor to perform continuous vacuum/sweeping of the entire Work area during the construction shift. The vacuum/sweepers shall be easily accessible to the Contractor and should be kept in a standby position should the Engineer or Airport require FOD removal. The Contractor shall move the vacuum/sweepers into standby position prior to commencement of each construction shift.

Vacuum Sweepers shall be Tymco, Model HSP-600 or Elgin Model crosswind sweepers.

The Contractor shall notify the Airport and Engineer prior to performing vacuum/sweeping on areas of the airport open to aircraft operations. It shall be necessary for the Airport or Engineer to obtain permission as necessary before the Contractor will be allowed to vacuum/sweep during operational hours. During vacuum/sweeping activities, the Contractor shall yield to all aircraft traffic. The Contractor shall provide vehicle monitors, as defined in Specification Item P-148 to provide supervision and control of vacuum/sweeper operations within the AOA.

The Contractor shall perform a complete vacuum/sweep of the entire Work area upon completion of each shift.

The Contractor shall provide a sufficient number of vacuum/sweepers to keep up with construction activities and provide thorough and continuous debris removal, but at a minimum shall provide 3 vacuum/sweepers for regular use and 1 back-up vacuum/sweeper on standby throughout the duration of the Work.

**50-24 Portable Construction Lighting.** The Contractor is responsible for providing work area lighting of sufficient quality and quantity to construct the Work to the quality standards called for in the Plans and Specifications. At a minimum the construction lighting shall meet the following requirements:

   a. For any construction that will be performed during nighttime hours the Contractor shall ensure that the work areas are adequately illuminated. A minimum of 10-foot candles of illumination shall be provided in the work areas, using maneuverable light plants with 1,000-watt metal halide floodlights, mounted as high as practicality will allow. The Contractor shall determine the number of light plants and their required spacing to achieve the illumination levels specified herein.

   The light should be positioned to provide the most natural color illumination and contrast with a minimum of shadows. The pavement area shall be lighted at a maximum spacing of 100 feet from both sides to eliminate objectionable shadows. A demonstration of the adequacy of the lighting will be required prior to beginning any night work. The Contractor shall work with Airport Operations
when determining positions for each portable light unit so that the lighting will not interfere with the vision of pilots or Air Traffic Control Tower personnel.

Any elevated lighting equipment to be left on the AOA when the pavement is open to aircraft operations, must be moved outside of the safety areas and object free areas of the runways and taxiways and lowered and positioned so as not to violate CFR Part 77 Civil Imaginary Surface obstacle criteria. These locations shall be subject to the final approval of the Engineer. Lighting equipment shall be stored in the Contractor’s staging areas, as shown on the Plans.

b. For night work, the Contractor shall equip all paving machines, rollers, distributor trucks, and other equipment with artificial illumination to safely illuminate the area immediately surrounding their work areas.

c. Contractor shall remove all equipment and store in the staging areas during non-working hours, and prior to the re-opening of the Runways.

50-25 Work by Others. The Contractor is advised that other work not part of this contract but within the AOA, may be performed concurrent with the Contractor’s work and by other contractors employed by the FAA or Airport. The Contractor shall closely coordinate and schedule his/her work with these other contractors completing work on the airfield. Prior to preparing the construction schedule and periodically during construction, the Contractor shall meet with the Engineer to discuss other work occurring on the airfield. The Contractor shall incorporate into the construction schedule any restrictions or dates required to make certain that conflicts with other contractors do not occur. No additional compensation will be made or contract time allowed for restrictions or disruptions to the Contractor’s work resulting from these other contractors.

50-26 Utilities Coordination Meeting. Prior to the start of the Work, the Contractor shall schedule a utility coordination meeting with the Owner, Engineer and applicable personnel of the Contractor in attendance, with the following agencies: the FAA and all utilities owners with facilities within the project area. The meeting shall primarily discuss coordination of any modifications, and the Contractor’s proposed procedures for protection of existing utilities. The topics of discussion shall also include: the Contractor’s locating and verification procedures, required permits, Contractor’s service shut-down schedules if applicable, Contractor’s understanding of required inspections by the utility owners, emergency notification procedures and emergency contacts, and other topics as deemed appropriate by the Engineer.

Payment for the utilities coordination meeting(s) shall be considered as included in the prices bid for the various items of Work and no additional payment will be made therefor.

50-27 Stakeholders Meeting. The Contractor shall schedule a meeting with the Airport stakeholders and applicable Airport and Contractor personnel to discuss the project status, Construction Phasing for upcoming work, planned airfield pavement closures, and other topics as deemed appropriate by the Engineer. Additional stakeholders meetings may also be required by the Engineer. Payment for the stakeholders meeting shall be considered as included in the prices bid for the various items of Work and no additional payment will be made therefor.

50-28 Payment. Unless specifically noted otherwise herein, payment for conforming to the requirements of Section 50 shall be considered as included in the unit prices bid for various items of work and no additional compensation will be made therefor.

50-29 Pay Items. All pay items relating to the Work indicated on the Plans and Specifications are listed in the Bid Proposal. The Contractor shall include all necessary costs to complete the Work within these items. Any work necessary to complete the Work as represented in the Plans and Specifications that is not specifically noted as a pay item on the Bid Proposal shall be considered incidental to the Work and no separate payment will be made.
50-30 Construction Cost Information. The Contractor shall furnish any and all cost information requested by the Engineer. The Airport or any of their authorized representatives shall be allowed access to any books, documents, papers and records of the Contractor which are directly pertinent to this Airport Improvement Project for the purpose of making audit, examination, excerpts and transcriptions.

END OF SECTION 50
Section 60 Control of Materials

60-01 Source of supply and quality requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish complete statements to the Engineer as to the origin, composition, and manufacture of all materials to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

The Contractor shall supply steel and manufactured products that conform to the Buy American provisions established under 49 USC Section 50101 as follows: “Steel products must be 100% U.S. domestic product Manufactured Products. Preference shall be given to products that are 100% manufactured and assembled in the U.S. Manufactured products not meeting the 100% U.S. domestic preference may only be used on the project if the FAA has officially granted a permissible waiver to Buy American Preferences. Submittals for all manufactured products must include certification of compliance with Buy American requirements as established under 49 USC Section 50101. Submittal must include sufficient information to confirm compliance or submittal will be returned with no action.

At the Engineer’s option, materials may be approved at the source of supply before delivery is stated. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is:

a. Listed in advisory circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program, and Addendum that is in effect on the date of advertisement; and,

b. Produced by the manufacturer as listed in the Addendum cited above for the certified equipment part number.

The following airport lighting equipment is required for this contract and is to be furnished by the Contractor in accordance with the requirements of this subsection:

Refer to the Plans for the airfield electrical items required.

60-02 Samples, tests, and cited specifications. Unless otherwise designated, all materials used in the work shall be inspected, tested, and approved by the Engineer before incorporation in the work. Any work in which untested materials are used without approval or written permission of the Engineer shall be performed at the Contractor’s risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the Engineer, shall be removed at the Contractor’s expense.

Unless otherwise designated, quality assurance (QA) tests in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), Federal Specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids, will be made by and at the expense of the Engineer.

The Contractor shall provide, on the construction site, copies of all referenced standards for use by all technicians and other personnel of the testing organizations performing on-site quality assurance field
tests. The Contractor’s Quality Control representatives may make use of this documentation at his or her request and at the sole discretion of the Engineer. In addition, the Contractor shall provide a 16-ft straighedge for use by QA personnel for the duration of the project. The Contractor provided straighedge shall be for the sole use of the QA testing. No separate measurement for payment will be made for providing this documentation and the straighedge, it shall be considered as a subsidiary obligation of the Contractor and covered under the other contract items. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the Engineer. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor’s representative at their request after review and approval of the Engineer.

The Contractor shall employ a testing organization to perform all Contractor required Quality Control (QC) tests. The Contractor shall submit to the Engineer resumes on all testing organizations and individual persons who will be performing the tests. The Engineer will determine if such persons are qualified. All the test data shall be reported to the Engineer after the results are known and within 24-hours of performing the testing. A legible, handwritten copy of all test data shall be given to the Engineer daily and within 24-hours of performing the testing, along with printed reports, in Adobe Acrobat® format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the Engineer showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests. The final report from the Contractor shall be furnished in Adobe Acrobat® version 10 electronic format. Contractor shall submit samples of materials, at the Contractor’s sole expense, as the Engineer may require, fifteen (15) days in advance of being incorporated in the Work. Samples shall be delivered by the Contractor to the Work site or other location within Monterey County, as determined by the Engineer.

Samples of materials to be tested shall be property identified and shall establish exact nature and character of materials. The Owner may reject any material or part thereof proven defective as a result of testing and will require satisfactory replacement.

The Contractor shall notify the Engineer at least 48 hours in advance of required on-site QA testing. Notifications made after 12:00 noon shall be considered as made on the following work day.

60-03 Certification of compliance. The Engineer may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer’s certificates of compliance stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the Engineer.

When a material or assembly is specified by “brand name or equal” and the Contractor elects to furnish the specified “brand name,” the Contractor shall be required to furnish the manufacturer’s certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

a. Conformance to the specified performance, testing, quality or dimensional requirements; and,

b. Suitability of the material or assembly for the use intended in the contract work.

Should the Contractor propose to furnish an “or equal” material or assembly, the Contractor shall furnish the manufacturer’s certificates of compliance as hereinbefore described for the specified brand name
material or assembly. However, the Engineer shall be the sole judge as to whether the proposed “or equal” is suitable for use in the work and whether or not the “or approved equal” has been tested. The Engineer reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 Plant inspection. The Engineer or his or her authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the Engineer conduct plant inspections, the following conditions shall exist:

a. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom the Engineer has contracted for materials.

b. The Engineer shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

c. If required by the Engineer, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Office or working space should be conveniently located with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The Engineer shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 Engineer’s field office. NOT USED.

60-06 Storage of materials. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the Engineer. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans, the storage of materials and the location of the Contractor’s plant and parked equipment or vehicles shall be as directed by the Engineer. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. The Contractor shall furnish the Engineer a copy of the property Owner’s permission prior to the storing of materials on the property.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at his or her entire expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

60-07 Unacceptable materials. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the Engineer.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the Engineer has approved its use in the work.

60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.
All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor’s handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor’s handling, storage, or use of Owner-furnished materials.

60-09 Shop Drawings and Equipment Submittals. All shop drawings, equipment and materials submittals shall be submitted to the Engineer within fifteen (15) working days after the preconstruction conference.

60-10 Item Equivalency. Where a specific manufacturer is noted on the Plans or listed in the Specifications herein, unless otherwise noted an “approved equal” item may be substituted.

If a bidder desires to bid an “approved equal” item, the bidder shall submit a request to do so to the Engineer in writing no later than seven (7) working days before bid opening. The request shall include all data necessary to substantiate that the item is equal. The Engineer will notify the bidder, in writing, of approval or disapproval of the equivalent item no later than three (3) working days before bid opening.

The Contractor shall also follow the requirements of Subsection 60-03, “Certification of Compliance” when requesting to bid an “approved equal” item.

60-11 Payment. Unless specifically noted otherwise herein, full payment for conforming to the requirements of Section 60 shall be considered as included in the unit prices bid for various items of work and no additional payment will be made therefor.

END OF SECTION 60
70-01 Laws to be observed. The Contractor shall keep fully informed of all Federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all his or her officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor’s employees.

70-02 Permits, licenses, and taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

The Contractor shall secure approval from the FAA for the installation and operation of a temporary batch plant within the staging areas if the contractor intends to place a batch plant on site. FAA form 7460-1 shall be used. Form 7460-1 and the application instructions can be obtained from the FAA’s web site at: http://www.faa.gov/airports/engineering/.

The Contractor shall become fully informed of the conditions of all permits that govern the Contractor’s operations and shall conduct construction operations accordingly. The Contractor shall be solely responsible for and pay, at Contractor’s sole expense, all fines, damages, and work delays incurred due to failure to implement the requirements of the permits.

FAA forms 7460-1 shall be submitted to the FAA within five (5) calendar days after receipt of the Notice to Proceed.

70-03 Patented devices, materials, and processes. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 Restoration of surfaces disturbed by others. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) is indicated as follows: FAA improvements to visual aids.

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the Engineer.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by
others whether or not such work by others is listed above. When ordered as extra work by the Engineer, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal aid participation. For Airport Improvement Program (AIP) contracts, the United States Government has agreed to reimburse the Owner for some portion of the contract costs. Such reimbursement is made from time to time upon the Owner’s request to the FAA. In consideration of the United States Government’s (FAA’s) agreement with the Owner, the Owner has included provisions in this contract pursuant to the requirements of Title 49 of the USC and the Rules and Regulations of the FAA that pertain to the work.

As required by the USC, the contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator, and is further subject to those provisions of the rules and regulations that are cited in the contract, plans, or specifications.

No requirement of the USC, the rules and regulations implementing the USC, or this contract shall be construed as making the Federal Government a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

The Engineer does not have authority over or responsibility for the job site safety and/or safety precautions and programs incident to the Contractor's work, nor for any failure of the Contractor to comply with laws and regulations applicable to the Contractor's furnishing and performing the work. The Contractor and all subcontractors shall execute the work in accordance with the provisions of all Federal, State, and local codes and requirements, including but not limited to OSHA and CAL/OSHA.

70-06 Sanitary, health, and safety provisions. The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of his or her employees as may be necessary to comply with the requirements of the state and local Board of Health, or of other bodies or tribunals having jurisdiction.

Attention is directed to Federal, state, and local laws, rules and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to his or her health or safety.

70-07 Public convenience and safety. The Contractor shall control his or her operations and those of his or her subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to his or her own operations and those of his or her subcontractors and all suppliers in accordance with the subsection 40-05 titled MAINTENANCE OF TRAFFIC of Section 40 hereinbefore specified and shall limit such operations for the convenience and safety of the traveling public as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80 hereinafter.

The Contractor shall take every precaution necessary to provide for the protection of personnel and property, including but not limited to airport users and employees, on or adjacent to the project site. The Contractor shall develop and submit for review and approval to the Owner and Engineer a “Construction Operation Safety Plan”. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work.

The Contractor shall develop and instate an Airport Construction Safety Training Program for all construction personnel performing work on the project. The program shall provide employee safety orientation covering all aspects of the FAA’s Advisory Circular 150/5370-2 (latest edition) Operational Safety on Airports during Construction, as well as the phasing restrictions and conditions as identified in
the Contract Documents. Attendance at the program is mandatory for all personnel performing work and/or delivering material to the site. Records for completion of the program, including attendees signatures indicating completion of the training, shall be maintained by the Contractor and made available at all times for inspection by the Owner and/or Engineer.

If the Contractor fails to maintain safety precautions or fails to instate the training program, the Owner shall take such steps as necessary, in the opinion of the Owner, to correct the situation and shall charge the Contractor therefor. The failure of the Owner to take any such action shall not relieve the Contractor of his obligations.

The Contractor shall not employ a construction technique or permit a construction activity, which in the opinion of the Owner or Engineer, adversely affects or interferes with Airport security and/or safety. The Contractor shall cooperate fully with the Owners requirements regarding airport security and safety of the project and the Airport.

The AOA will be in continuous use for scheduled and unscheduled aircraft during the construction period. Use of the AOA by aircraft and airport operations shall take precedence over the Contractor's operations at all times. The Contractor shall bid and perform the work accordingly.

The Contractor shall cooperate fully with the Owner and the Engineer in matters pertaining to public safety and Airport Operations. No additional compensation or contract time will be allowed for delays, cancelations, or disruption of construction work as a result of Airport Operations which may require that the Contractor's operations be interrupted, canceled, changed, reconfigured, or moved from one part of the project site to another.

70-08 Barricades, warning signs, and hazard markings. The Contractor shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to protect the public and the work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated. Unless otherwise specified, barricades, warning signs, and markings for hazards that are in the air operations area (AOAs) shall be a maximum of 18 inches (0.5 m) high. Unless otherwise specified, barricades shall be spaced not more than 4 feet (1.2 m) apart. Barricades, warning signs, and markings shall be paid for under subsection 40-05.

For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices.

When the work requires closing an air operations area of the airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of advisory circular (AC) 150/5340-1, Standards for Airport Markings.

The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and the Contractor’s parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to AC 150/5370-2, Operational Safety on Airports During Construction.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work that requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their removal is directed by the Engineer.

Open-flame type lights shall not be permitted.

70-09 Use of explosives. The use of explosives shall not be permitted on or within the Airport property.
70-10 Protection and restoration of property and landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at his or her own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

The Contractor is hereby informed that there are installed on the Airport NAVAIDS including, without limitation; electric cables and controls relating to visual aids and facilities, and other electric power cables serving other airport facilities. Such NAVAIDS and other facilities, and electric cables shall be fully protected during the entire construction time unless otherwise noted on the Plans. Work can be accomplished in the vicinity of these facilities and cables only at approved periods of time. Approval is subject to withdrawal at any time because of changes in the weather, emergency conditions on the airfield, anticipation of emergency conditions, and for any other reason determined by the Engineer acting under the orders and instructions of the Airport or the designated FAA representative. Any instructions to the Contractor to clear any given area, at any time, by the Engineer, the Airport or the FAA (by radio or other means) shall be immediately executed. Construction work may be commenced in the cleared area only when additional instructions are issued by the proper authorities.

The Contractor shall immediately repair, with identical material by skilled workmen, underground cables serving the Airport or NAVAIDS and other Airport facilities, which are damaged by its workers, equipment or work. Prior approval of the FAA must be obtained for the materials, workers, time of day or night, method of repairs, and for any temporary or permanent repairs the Contractor proposes to make to any FAA facilities damaged by the Contractor. Prior approval of the Engineer and the Airport Manager shall be obtained for the materials, workers, time of day or night, and for the method of repairs for any temporary or permanent repairs the Contractor proposes to make to any other airport Airport facilities and cable damaged by the Contractor.

It is recognized that the Airport will incur costs for employees' salaries, engineering fees, and otherwise in connection with the damage and inspection and repair of any such damage, caused by the Contractor and, consequently, that the Airport may incur loss of income by reason of the diversion of aircraft and that such expenses and loss of income are damages that would be impracticable or extremely difficult to determine. In addition to the obligation of the Contractor to immediately repair any cables or facilities damaged by the Contractor within three feet of the location on the ground defined by the Engineer, as set forth above, the parties agree that the sum of $2,000.00 per calendar day shall be fixed as liquidated damages (and not as a penalty or forfeiture for breach), and shall be deducted from any money due the Contractor, or if no money is due the Contractor, the Owner shall have the right to recover said sum or sums from the Contractor, from the Surety, or from both.

Non-inclusion of items from the above information shall not relieve the Contractor from protecting and restoring all Airport improvements as required.

The Contractor shall repair or replace all Airport-owned facilities that are damaged as a result of its operations. At the option of the Airport, the repair or replacement work may be performed by Airport
personnel. In either case, the Contractor shall pay at its sole expense, all costs for restoring existing improvements.

The cost of protection and restoration of property and landscape shall be considered as included in the unit prices bid for various items of work and no additional payment will be made therefor.

70-11 Responsibility for damage claims. The Contractor shall indemnify and save harmless the Engineer and the Owner and their officers, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the “Workmen’s Compensation Act,” or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of his or her contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, his or her surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 Third party beneficiary clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 Opening sections of the work to traffic. Should it be necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such “phasing” of the work shall be specified herein and indicated on the plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified. The Contractor shall make his or her own estimate of the difficulties involved in arranging the work to permit such beneficial occupancy by the Owner as described below:

Phase Completion Sequence: Refer to the Construction Phasing Plans for details.

Upon completion of any portion of the work listed above, such portion shall be accepted by the Owner in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50.

No portion of the work may be opened by the Contractor for public use until ordered by the Engineer in writing. Should it become necessary to open a portion of the work to public traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the Engineer, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at his or her expense.

The Contractor shall make his or her own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

Contractor shall be required to conform to safety standards contained AC 150/5370-2 (see Special Provisions).
Contractor shall refer to the approved Phasing Plans and the Construction Safety Phasing Plan (CSPP) to identify barricade requirements and other safety requirements prior to opening up sections of work to traffic.

**70-14 Contractor’s responsibility for work.** Until the Engineer’s final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at his or her expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

No reimbursement will be made for work necessitated by the Contractor’s failure to comply with the requirements of the SWPPP.

**70-15 Contractor’s responsibility for utility service and facilities of others.** As provided in the subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section, the Contractor shall cooperate with the Owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and the Owners are indicated as follows:

**Service or Facility:** NAVAID’s and Visual Aids Facilities

**Person to Contract:** To be advised following contract award.

**Service or Facility:** City Water Distribution System

**Person to Contract:** To be advised following contract award.

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of his or her plan of operations. Such notification shall be
in writing addressed to THE PERSON TO CONTACT as provided in this subsection and subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the Engineer.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor’s opinion, the Owner’s assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner’s PERSON TO CONTACT no later than two normal business days prior to the Contractor’s commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the Engineer.

The Contractor’s failure to give the two days’ notice shall be cause for the Owner to suspend the Contractor’s operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet (1 m) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor’s operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the Engineer and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the Engineer continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or his or her surety.

70-15.1 FAA facilities and cable runs. The Contractor is hereby advised that the construction limits of the project include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the execution of the project work, shall comply with the following:

a. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

b. The Contractor shall provide notice to the FAA Air Traffic Organization (ATO)/Technical Operations/System Support Center (SSC) Point-of-Contact through the airport Owner a minimum of seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

c. If execution of the project work requires a facility outage, the Contractor shall contact the FAA Point-of-Contact a minimum of 72 hours prior to the time of the required outage.

d. Any damage to FAA cables, access roads, or FAA facilities during construction caused by the Contractor’s equipment or personnel whether by negligence or accident will require the Contractor to repair or replace the damaged cables, access road, or FAA facilities to FAA requirements. The Contractor shall not bear the cost to repair damage to underground facilities or utilities improperly located by the FAA.

e. If the project work requires the cutting or splicing of FAA owned cables, the FAA Point-of-Contact shall be contacted a minimum of 72 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA representative on site to observe the splicing of the cables as a condition.
of acceptance. All cable splices are to be accomplished in accordance with FAA specifications and require approval by the FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

**70-16 Furnishing rights-of-way.** The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor’s operations.

**70-17 Personal liability of public officials.** In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, his or her authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

The Contractor shall indemnify, hold harmless, and defend the City, its Council, and their officials, employees, and agents and Kimley-Horn and Associates, Inc. from and against any and all demands, claims, causes of action, liens, liability, loss, damage, costs, and expenses (including attorney's fees) arising from or in any way connected or alleged to be connected with Contractor's performance of the Work, and from any act or omission, willful misconduct, or negligence (active or passive) by or alleged to be by Contractor, its employees, agents, or subcontractors, either as a sole or contributory cause, sustained by any person or entity (including, but not limited to, any employee or representative of the City or the Contractor). The foregoing shall not apply to claims or causes of action caused by the sole negligence of the City, its Council, or their officials, employees, or agents.

With respect to any premises or equipment of the City made use of in the performance of the Contract, the Contractor shall have inspected same prior to use, accepted them in good and safe condition and agree to maintain them in a safe condition for the protection of its employees while using them during the performance of the Work.

The Contractor shall indemnify, hold harmless, save and defend the City, its Council, and their officials, agents and employees from and against any and all demands, claims, causes of action, liens, liability, loss, damage, costs and expenses (including attorneys' fees) arising out of City's statutory obligations pertaining to safety of or defective conditions in any premises, materials or equipment owned by or supplied by the City, including obligations under the California Safe Place to Work statutes or any similar statutes relating to dangerous conditions of public property or laws pertaining to the provision of safe place to work or safe equipment for employees.

**70-18 No waiver of legal rights.** Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or his or her surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill his or her obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner’s rights under any warranty or guaranty.

**70-19 Environmental protection.** The Contractor shall comply with all Federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.
70-20 Archaeological and historical findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during his or her operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the Engineer. The Engineer will immediately investigate the Contractor’s finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor’s operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in the subsection 40-04 titled EXTRA WORK of Section 40 and the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of Section 80.

70-21 Protection Of Employees And Others. The Contractor shall, at its sole expense, take such precautions as are necessary to protect workers engaged in the performance of the Work specified hereunder and to prevent accidents or injury to such workers or others. The Contractor shall comply with all safety orders of the Division of Industrial Safety of the State of California as well as applicable Federal regulations insofar as the same pertain to the Contractor’s operations. Should any unusual or hazardous condition exist by reason of the Work to be performed or should any unusual or hazardous condition arise out of the performance of such Work, or should a condition involving a peculiar risk of bodily harm to workers or others arise, then the Contractor shall take all precautions necessary to protect workers and others.

70-22 Payment. Unless specifically noted otherwise herein, payment for conforming to the requirements of Section 70 shall be considered as included in the unit prices bid for various items of work and no additional payment will be made therefor.

END OF SECTION 70
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Section 80 Execution and Progress

80-01 Subletting of contract. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Engineer.

The Contractor shall provide copies of all subcontracts to the Engineer. The Contractor shall perform, with his organization, an amount of work equal to at least 25 percent of the total contract cost awarded.

Should the Contractor elect to assign his or her contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

In accordance with the provisions of the Public Contract Code, Section 4100 et seq., the Bidder shall indicate all subcontractors who will perform labor or render services to the Contractor equal to or greater than one-half of one percent of the total Bid.

When a portion of the Work has been subcontracted by the Contractor and the work is not being done in a manner satisfactory to the Engineer, the Contractor shall, upon request, immediately and permanently remove such subcontractor from the Work.

80-02 Notice to proceed. The notice to proceed shall state the date on which it is expected the Contractor will begin the construction and from which date contract time will be charged. The Contractor shall begin the work to be performed under the contract within 10 calendar days of the date set by the Engineer in the written notice to proceed, but in any event, the Contractor shall notify the Engineer at least 24 hours in advance of the time actual construction operations will begin. The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the Owner.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their progress schedule for the Engineer’s approval within a maximum of 10 calendar days after the effective date of the notice to proceed but no later than at the pre-construction conference. The Contractor’s progress schedule, when approved by the Engineer, may be used to establish major construction operations and to check on the progress of the work. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the Engineer’s request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the Owner. However, after the award of the Contract and prior to the Notice to Proceed, the Contractor is encouraged to submit shop drawings, mix designs and the various submittals required for the Work.

80-04 Limitation of operations. The Contractor shall control his or her operations and the operations of his or her subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.
When the work requires the Contractor to conduct his or her operations within an AOA of the airport, the work shall be coordinated with airport operations (through the Engineer) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the Engineer and until the necessary temporary marking and associated lighting is in place as provided in the subsection 70-08 titled BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS of Section 70.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor’s operations in the AOA until the satisfactory conditions are provided. The following AOA cannot be closed to operating aircraft to permit the Contractor’s operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows:

AOA: All areas bounded by the perimeter fence of Airport.

TIME PERIODS AOA CAN BE CLOSED: Refer to Phase Plans for work area limits and associated closure periods.

TYPE OF COMMUNICATIONS REQUIRED WHEN WORKING IN AN AOA:

a) Continuous and direct communications with the Airport using cellular phones. The Contractors superintendent(s), all gate guards and flaggers, shall carry cellular phones at all times while construction operations are in progress. The Contractor shall provide the Airport with the list of cell phone numbers for the superintendants, gate guards and flaggers prior to the start of any construction activities;

b) Continuous monitoring of airtraffic communications on Common Traffic Advisory Frequency (CTAF). The Contractor shall purchase and provided four (4) VHF Air Band Transceivers for monitoring CTAF communications. The transceivers shall be model IC-A6 by ICOM®. The Contractor senior superintendent and all flaggers shall monitor communications on CTAF at all times during construction activities. Upon completion of the project the Contractor shall hand over the VHF Air Band Transceivers including all changers, to the Airport. The Airport will retain ownership of the transceivers upon project completion. If during the construction operations the transceivers are damaged or abused, the Contractor shall replaced the equipment in kind and at the Contractor’s sole cost.

Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction (see Appendix).

**80-04.1 Operational safety on airport during construction.** All Contractors’ operations shall be conducted in accordance with the project phasing plans, the Construction Safety and Phasing Plan (CSPP), and the provisions set forth within the current version of AC 150/5370-2. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a Safety Plan Compliance Document that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and that they implement and maintain all necessary measures.
No deviation or modifications may be made to the approved CSPP unless approved in writing by the Owner or Engineer.

**80-05 Character of workers, methods, and equipment.** The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the Engineer.

Should the Contractor fail to remove such persons or person, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the Engineer may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall be such that no injury to previously completed work, adjacent property, or existing airport facilities will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this subsection.

**80-06 Temporary suspension of the work.** The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods as the Owner may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the execution of the work, or for such time as is necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the Engineer’s order to suspend work to the effective date of the Engineer’s order to
resume the work. Claims for such compensation shall be filed with the Engineer within the time period stated in the Engineer’s order to resume work. The Contractor shall submit with his or her claim information substantiating the amount shown on the claim. The Engineer will forward the Contractor’s claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather, for suspensions made at the request of the Owner, or for any other delay provided for in the contract, plans, or specifications.

If it should become necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-07 Determination and extension of contract time. The number of calendar or working days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the CONTRACT TIME.

Should the contract time require extension for reasons beyond the Contractor’s control, it shall be adjusted as follows:

   a. CONTRACT TIME based on WORKING DAYS shall be calculated weekly by the Engineer. The Engineer will furnish the Contractor a copy of his or her weekly statement of the number of working days charged against the contract time during the week and the number of working days currently specified for completion of the contract (the original contract time plus the number of working days, if any, that have been included in approved CHANGE ORDERS or SUPPLEMENTAL AGREEMENTS covering EXTRA WORK).

   The Engineer shall base his or her weekly statement of contract time charged on the following considerations:

      (1) No time shall be charged for days on which the Contractor is unable to proceed with the principal item of work under construction at the time for at least six (6) hours with the normal work force employed on such principal item. Should the normal work force be on a double-shift, 12 hours shall be used. Should the normal work force be on a triple-shift, 18 hours shall apply. Conditions beyond the Contractor’s control such as strikes, lockouts, unusual delays in transportation, temporary suspension of the principal item of work under construction or temporary suspension of the entire work which have been ordered by the Owner for reasons not the fault of the Contractor, shall not be charged against the contract time.

      (2) The Engineer will not make charges against the contract time prior to the effective date of the notice to proceed.

      (3) The Engineer will begin charges against the contract time on the first working day after the effective date of the notice to proceed.

      (4) The Engineer will not make charges against the contract time after the date of final acceptance as defined in the subsection 50-15 titled FINAL ACCEPTANCE of Section 50.

      (5) The Contractor will be allowed one (1) week in which to file a written protest setting forth his or her objections to the Engineer’s weekly statement. If no objection is filed within such specified time, the weekly statement shall be considered as acceptable to the Contractor.

The contract time (stated in the proposal) is based on the originally estimated quantities as described in the subsection 20-05 titled INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES of Section 20. Should the satisfactory completion of the contract require performance of work in greater quantities than those estimated in the proposal, the contract time shall be increased in the same proportion
as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in
the proposal. Such increase in contract time shall not consider either the cost of work or the extension of
contract time that has been covered by change order or supplemental agreement and shall be made at the
time of final payment.

b. Contract Time based on calendar days shall consist of the number of calendar days stated in the
contract counting from the effective date of the notice to proceed and including all Saturdays, Sundays,
holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner’s
orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of
the actually completed quantities bears to the cost of the originally estimated quantities in the proposal.
Such increase in the contract time shall not consider either cost of work or the extension of contract time
that has been covered by a change order or supplemental agreement. Charges against the contract time
will cease as of the date of final acceptance.

c. When the contract time is a specified completion date, it shall be the date on which all contract
work shall be substantially complete.

If the Contractor finds it impossible for reasons beyond his or her control to complete the work within the
contract time as specified, or as extended in accordance with the provisions of this subsection, the
Contractor may, at any time prior to the expiration of the contract time as extended, make a written
request to the Owner for an extension of time setting forth the reasons which the Contractor believes will
justify the granting of his or her request. Requests for extension of time on calendar day projects, caused
by inclement weather, shall be supported with National Weather Bureau data showing the actual amount
of inclement weather exceeded what could normally be expected during the contract period. The
Contractor’s plea that insufficient time was specified is not a valid reason for extension of time. If the
supporting documentation justify the work was delayed because of conditions beyond the control and
without the fault of the Contractor, the Owner may extend the time for completion by a change order that
adjusts the contract time or completion date. The extended time for completion shall then be in full force
and effect, the same as though it were the original time for completion. No such extension shall operate in
any manner, to excuse or release Contractor or its sureties from any other obligation under the Contract
or, in any other manner, to vary, modify or extend any other term or condition therein contained.

80-08 Failure to complete on time. For each calendar day or working day, as specified in the contract,
that any work remains uncompleted after the contract time (including all extensions and adjustments as
provided in the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME
of this Section) the sum specified in the contract and proposal as liquidated damages will be deducted
from any money due or to become due the Contractor or his or her surety. Such deducted sums shall not
be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages
including but not limited to additional engineering services that will be incurred by the Owner should the
Contractor fail to complete the work in the time provided in their contract.

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<th>Schedule</th>
<th>Liquidated Damages Cost</th>
<th>Allowed Construction Time</th>
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| Runway Nightly Closures | $250 per minute or any part thereof for the first 10 minutes;  
                          | $500 per minute or any part thereof for all subsequent minutes.                     | Nightly Closure shall be from 9:00PM to 7:00AM |
Schedule | Liquidated Damages Cost | Allowed Construction Time
--- | --- | ---
All work included in the following Phases: Phase 1, Phase 2, and Phase 3 | $10,000 per calendar day or any part thereof. | 45 consecutive calendar days from the Notice to Proceed
All work included in the following Phases: Phases 1 through 6 inclusive | $10,000 per calendar day or any part thereof. | 65 consecutive calendar days from the Notice to Proceed
Base Bid | $7,500 per calendar day or any part thereof. | 67 consecutive calendar days from the Notice to Proceed
Additive Alternative No. 2 (If awarded) | $7,500 per calendar day or any part thereof. | An additional 15 consecutive calendar days

No additional time will be added to the contract time if Additive Alternative No. 1 is awarded.

The maximum construction time allowed for the Base Bid and all additive alternatives awarded will be the sum of the time allowed for the Base Bid plus the time allowed for Additive Alternative No. 2 but not more than 82 calendar days. Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the contract.

80-09 Default and termination of contract. The Contractor shall be considered in default of his or her contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons if the Contractor:

a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or

b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or

c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or

d. Discontinues the execution of the work, or

e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or

h. Makes an assignment for the benefit of creditors, or

i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Engineer consider the Contractor in default of the contract for any reason above, the Engineer shall immediately give written notice to the Contractor and the Contractor’s surety as to the reasons for considering the Contractor in default and the Owner’s intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the Engineer of the facts of such delay, neglect, or default and the Contractor’s failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The
Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Engineer will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

80-10 Termination for national emergencies. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer.

Termination of the contract or a portion thereof shall neither relieve the Contractor of his or her responsibilities for the completed work nor shall it relieve his or her surety of its obligation for and concerning any just claim arising out of the work performed.

80-11 Work area, storage area and sequence of operations. The Contractor shall obtain approval from the Engineer prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate his or her work in such a manner as to ensure safety and a minimum of hindrance to flight operations. All Contractor equipment and material stockpiles shall be stored a minimum or 250 feet from the centerline of an active runway. No equipment will be allowed to park within the approach area of an active runway at any time. No equipment shall be within 200 feet of an active runway at any time.

80-12 PRECONSTRUCTION CONFERENCE. Prior to the commencement of the Work and after the execution of the Contract, the Engineer will contact the Contractor to make arrangements for a preconstruction conference with all interested parties.

The Contractor shall submit a written proposed construction schedule to the Engineer at the preconstruction conference. Attendance by the Contractor's personnel who will be on the Work site daily is required.

At the preconstruction conference, procedures for working on the Airport will be reviewed with the Engineer, Airport personnel and others affected by construction on the Airport. Operational, safety, and security requirements will be reviewed as will construction coordination with aircraft operations and airport stakeholders and users.

The Contractor will be advised who the specific individual is who has the authority of Engineer as specified herein. Other individuals who have authority in various types of activity such as Airport Security, Airport Operations and FAA and other related parties will be identified.
80-13 NIGHT WORK. Night work between the hours of 9:00 p.m. and 7:00 a.m. is required for this Contract in accordance with these Specifications and as shown on the Plans. The Contractor shall include incidental expenses for night work such as extra labor costs, standby equipment costs, lighting costs, etc, in the various bid items, and no additional payment will be made therefor.

80-20 PAYMENT. Unless specifically noted otherwise herein, payment for conforming to the requirements of Section 80 shall be considered as included in the unit prices bid for various items of work and no additional payment will be made therefor

END OF SECTION 80
90-01 Measurement of quantities. All work completed under the contract will be measured by the Engineer, or his or her authorized representatives, using United States Customary Units of Measurement or the International System of Units.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet (0.8 square meters) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

In computing volumes of excavation the average end area method or other acceptable methods will be used.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.

The term “ton” will mean the short ton consisting of 2,000 lb (907 km) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, approved scales by competent, qualified personnel at locations designed by the Engineer. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the Engineer directs, and each truck shall bear a plainly legible identification mark.

Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Bituminous materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts or ASTM D633 for tars.
Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

When bituminous materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, may be used for computing quantities.

Cement will be measured by the ton (kg) or hundredweight (km).

Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract.

When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered by the Engineer in connection with force account work will be measured as agreed in the change order or supplemental agreement authorizing such force account work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of this section.

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales.

Scales shall be accurate within 1/2% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of 1% of the nominal rated capacity of the scale, but not less than 1 pound (454 grams). The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

Scale installations shall have available ten standard 50-pound (2.3 km) weights for testing the weighing equipment or suitable weights and devices for other approved equipment.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales “overweighing” (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of one-half of 1%.

In the event inspection reveals the scales have been underweighing (indicating less than correct weight), they shall be adjusted, and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.

All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the
weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.

When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the Engineer. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 Scope of payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of the subsection 70-18 titled NO WAIVER OF LEGAL RIGHTS of Section 70.

When the “basis of payment” subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the work. Work which is not specifically covered in the Contract Documents may be required if such work is consistent with intent of the Contract Documents and is reasonably inferable as being necessary to produce the intended results. The Engineer shall have the final decision over what work is reasonably inferable. All work necessary to meet the intent of the Contract Documents shall be performed by the Contractor under the Contract. If there is no quantity shown in the bidding schedule, the work shall be considered as a subsidiary obligation of the Contractor covered under the other contract items. Words and abbreviations in the Contract Documents that have well known technical or trade meanings are used in accordance with such recognized meanings.

90-03 Compensation for altered quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his or her unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 Payment for omitted items. As specified in the subsection 40-03 titled OMITTED ITEMS of Section 40, the Engineer shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the Engineer omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the Engineer’s order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the Engineer’s order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the Engineer’s order. Such additional costs incurred by the Contractor must be directly related to the deleted contract
item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

**90-05 Payment for extra work.** Extra work, performed in accordance with the subsection 40-04 titled EXTRA WORK of Section 40, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

**90-06 Partial payments.** Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the Contractor and reviewed and accepted by the Engineer, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with the subsection 90-07 titled PAYMENT FOR MATERIALS ON HAND of this section. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

The Contractor shall submit the progress payment pay application to the Engineer for review and approval. The Engineer shall review it within ten (10) calendar days of receipt. The Engineer shall either deny and return the progress payment pay application to the Contractor for correction, or recommend approval and forward it to the Owner for processing. The required attachments to the monthly progress payment pay applications shall include:

a. Certified Payroll Reports: All current certified payroll reports and statement of compliance for the Contractor and all subcontractors (to be completed through the date of the pay application; duplicate originals are required).

b. Contractor Record Drawings: The Contractor’s “As-Built” Record Drawings shall be complete and current at the time of the monthly pay application. The Engineer in conjunction with the Contractor, shall review the current “As-Built” Record Drawings at the time the payment application is submitted. If the Engineer determines that the Record Drawings are not current or compete, the Engineer will suspend further review of the pay application until the Contractor updates and/or corrects the Record Drawings. The review and subsequent processing of the pay application will not re-commence until the Engineer determines that the Contractor has corrected the “As-Built” Record Drawings and they are current and complete.

c. Quantity Calculations: Certified earthwork quantity calculations to justify all pay quantities and amounts requested.

d. Monthly Schedule: The Contractor shall submit an updated, revised Critical Path Method (CPM) schedule to the Engineer with each pay application. The CPM schedule shall be submitted in both paper and original electronic format.

e. All Permit Registration Documents (PRDs) are current and if applicable filed, by the designated Contractor’s data provider, through the Regional Water Quality Control Board’s (RWQCB) Stormwater Multi-Application & Report Tracking System (SMARTS) website; including, all sampling analysis and monitoring for pH and turbidity, project change of information, and annual reporting and associated fees.

f. All Best Management Practice’s (BMP’s) currently employed on the project are in good working condition as deemed acceptable by the Engineer.

Failure to provide any of the documents as listed above will result in the Engineer returning the monthly pay application to the Contractor with no action.

The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. The Owner must ensure prompt and full payment of retainage from the prime Contractor to the subcontractor within 30 days after the subcontractor’s work is satisfactorily completed. A subcontractor’s work is satisfactorily completed when
all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

From the total of the amount determined to be payable on a partial payment, 5 percent of such total amount will be deducted and retained by the Owner until the final payment is made, except as may be provided (at the Contractor’s option) in the subsection 90-08 titled PAYMENT OF WITHHELD FUNDS of this section. The balance 95 percent of the amount payable, less all previous payments, shall be certified for payment. Should the Contractor exercise his or her option, as provided in the subsection 90-08 titled PAYMENT OF WITHHELD FUNDS of this section, no such percent retainage shall be deducted.

When at least 95% of the awarded work has been completed, the Engineer shall, at the Owner’s discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done.

The Owner may retain an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the Engineer to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in the subsection 90-09 titled ACCEPTANCE AND FINAL PAYMENT of this section.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

**90-07 Payment for materials on hand.** Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the Engineer at or on an approved site.

b. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the Engineer with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material so stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material so stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.
It is understood and agreed that the transfer of title and the Owner’s payment for such stored or stockpiled materials shall in no way relieve the Contractor of his or her responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this subsection.

90-08 Payment of withheld funds. At the Contractor’s option, if an Owner withholds retainage in accordance with the methods described in subsection 90-06 PARTIAL PAYMENTS, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner’s deposit of retainage into an escrow account is subject to the following conditions:

a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.

b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 Acceptance and final payment. When the contract work has been accepted in accordance with the requirements of the subsection 50-15 titled FINAL ACCEPTANCE of Section 50, the Engineer will prepare the final estimate of the items of work actually performed. The Contractor shall approve the Engineer’s final estimate or advise the Engineer of the Contractor’s objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the Engineer shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor’s receipt of the Engineer’s final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the Engineer’s estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with the subsection 50-16 titled CLAIMS FOR ADJUSTMENT AND DISPUTES of Section 50.

After the Contractor has approved, or approved under protest, the Engineer’s final estimate, and after the Engineer’s receipt of the project closeout documentation required in subsection 90-11 Project Closeout, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of the subsection 50-16 titled CLAIMS FOR ADJUSTMENTS AND DISPUTES of Section 50 or under the provisions of this subsection, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 Construction warranty.

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material,
workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date of the final acceptance of the entire work. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work.

c. The Contractor shall remedy at the Contractor’s expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor’s expense any damage to Owner real or personal property, when that damage is the result of:

   (1) The Contractor’s failure to conform to contract requirements; or

   (2) Any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor’s warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within 14 days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor’s expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner’s rights with respect to latent defects, gross mistakes, or fraud.

90-11 Project closeout. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the Engineer approves the Contractor’s final submittal. The Contractor shall:

a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with subsection 40-08, FINAL CLEANUP.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer's certifications for all items incorporated in the work.
i. All required record drawings, as-built drawings or as-constructed drawings.


l. Equipment commissioning documentation submitted, if required.

m. Contractor’s Quality Control Report – this document shall comprise of all quality control reports performed for the project compiled by specification section and in chronological order. The report shall be submitted in Adobe Acrobat® format.

90-12 Estimated Quantities. The quantities in the bid schedule stated herein are estimates. The Contractor shall furnish whatever quantities are actually needed to complete the Work, whether the quantities are more or less than the estimates, at the unit prices bid. There is no guarantee that the total amount bid will be reached, and it may be exceeded.

END OF SECTION 90
Section 100 Contractor Quality Control Program

100-01 General. 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 here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The Engineer and/or the Engineer’s representatives will, at the Engineer’s discretion, monitor the performance of the Contractor's Quality Control staffing levels and personnel through the duration of the Contract.

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, their 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 and accepted 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 and accepted by the Engineer.

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.

Paving projects over $250,000 shall have a Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Contractor, subcontractors, testing laboratories, and Owner’s representative and the FAA prior to or at start of construction. The workshop shall address QC and QA requirements of the project specifications. The Contractor shall coordinate with the Airport and the Engineer on time and location of the QC/QA workshop.

100-02 Description of program.

   a. General description. The Contractor shall establish a Quality Control Program to perform quality control 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 and approved 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 and approval at least five (5) calendar days before the preconstruction conference.
The Contractor’s Quality Control Plan and Quality Control testing laboratory must be approved in writing
by the Engineer prior to the Notice to Proceed (NTP).

The Quality Control Program shall be organized to address, as a minimum, the following items:

   a. Quality control organization
   b. Project progress schedule
   c. Submittals schedule
   d. Inspection requirements, (at a minimum for each bid item and specification);
   e. Quality control testing plan, (at a minimum for each bid item and specification);
   f. Documentation of quality control activities
   g. Requirements for corrective action when quality control and/or acceptance criteria are not met; and
   h. Technician and inspection staffing levels and identification of designated personnel for each type
      of construction operation: (at a minimum the following shall be addressed: asphalt pavement
      removal, cold planning, and pavement marking obliteration; excavations; installation of geogrid;
      grading; asphalt concrete paving; saw cutting; sealing of joints; electrical duct bank and conduit
      installation, and compaction of trenches; installation and testing of conductor and ground wires;
      installation and testing of airfield signs and edge lighting; installation of pavement markings).

The Contractor is encouraged to add any additional elements to the Quality Control Program that is
deemed 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 used 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, as a minimum, consist of the following personnel:

   a. Program Administrator. The Program Administrator shall be a full-time on-site employee of the
      Contractor, or a consultant engaged by the Contractor. The Program Administrator shall have a minimum
      of ten (10) 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.

      Additional qualifications for the Program Administrator shall include the following requirements:

      (1) California Licensed Professional Engineer with five (5) years of airport paving experience
          using P-401 material on projects funded by the FAA’s AIP.
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 shall report directly to a responsible officer of the construction firm. The Program Administrator may supervise the Quality Control Program on more than one project provided: 1) that person can be at the job site within two (2) hours after being notified of a problem; and 2) the Program Administrator is assigned to the Project on a full-time basis during the following work elements; the P-401 Bituminous Surface Course placement.

b. Quality control technicians. 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 craftsmen 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.

The quality control technicians 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 subsection 100-06.

(2) Performance of all quality control tests and inspections as required by the technical specifications and subsection 100-07.

(3) Performance of density tests for the Engineer when required by the technical specifications.

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.

If a construction activity or element is found to have an unacceptable level of Quality Control technicians and inspectors as determined by the Engineer; the activity will be suspended until an approved level of Quality Control is reestablished. No additional compensation will be made and no additional contract time will be allowed for the suspension of the work for unacceptable or insufficient level of Quality Control; all associated costs shall be borne solely by the Contractor.

The Contractor shall submit to the Engineer on a weekly basis, the number of Quality Control technicians and inspectors anticipated for the following two (2) weeks for each work element.

100-04 Project progress schedule. The Contractor shall submit a coordinated construction schedule for all work activities. The schedule shall be prepared as a network diagram in Critical Path Method (CPM) or other format, or as otherwise specified in the contract. As a minimum, it shall provide information on the sequence of work activities, milestone dates, and activity duration. The Contractor’s schedule shall include milestone dates for the following material submittals: structural geogrid material, P-208 Aggregate Base Course, P-209 Crushed Aggregate Base Course, P-401 Job Mix Formula (JMF), P-401 material certifications, airfield signs and edge lights submittals, and all anticipate permit issuance dates.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.
100-05 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing shall be submitted to the Engineer prior to the start of on-site construction activities. The listing shall be developed in a spreadsheet format and submitted electronically and shall include:

a. Specification item number
b. Item description
c. Description of submittal
d. Specification paragraph requiring submittal
e. Scheduled date of submittal

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 subsection 100-07.

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:

a. During plant operation for material production, quality control test results and periodic inspections shall be used 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 used 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 used.

b. During field operations, quality control test results and periodic inspections shall be used to ensure the quality of all materials and workmanship. All equipment used 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 used.

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 (for example, P-401)
b. Item description (for example, Plant Mix Bituminous Pavements)
c. Test type (for example, gradation, grade, asphalt content)
d. Test standard (for example, ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)
e. Test frequency (for example, as required by technical specifications or minimum frequency when requirements are not stated)
f. Responsibility (for example, plant technician and technician’s name)
g. Control requirements (for example, target, permissible deviations)
The testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. 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 subsection 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. These technician’s daily reports shall be provided to the Engineer for project records and 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
(7) Safety inspection.

The daily inspection reports shall identify construction element or activity, construction equipment utilized for the element, project location by station and offset and grade elevation, prevailing weather during test, 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 responsible quality control technician and the Program Administrator. The Engineer shall be provided with one (1) hard-copy and an electronic scan in Adobe Acrobat® copy of each daily inspection report on the work day following the day 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 to include station and offset, and grade elevation
(4) Date and time of test
(5) Control requirements
(6) Test results
(7) Causes for rejection
(8) Recommended remedial actions
(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 use 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 and/or the Engineer’s representatives 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 here 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. 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 or her authorized representative to the Contractor or his or her authorized representative at the site of the work, shall be considered sufficient notice.

b. In cases where quality control activities do not comply with either the Contractor 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, the Engineer 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 are taken.
**Section 105 Mobilization**

105-1 **Description.** This item shall consist of work and operations, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

Mobilization/Demobilization shall consist of preparatory work and operations, including: the installation of the staging area(s); the installation of all temporary utilities to the staging area(s); the establishment of site access including all temporary asphalt and concrete pavement entrances; the establishment of site field offices and buildings; the movement of personnel, equipment, materials, supplies and incidentals to the project site; the establishment of the Quality Assurance (QA) Testing Laboratory; the establishment of the contractor’s haul roads, and other facilities necessary for the performance of the Work; other necessary preparatory work and operations prior to the commencement of the work; and for necessary work and costs in completing the construction and demobilizing from the site. Demobilization shall include: removal of temporary utilities to the staging areas; removal of temporary field offices; removal of all temporary facilities and improvements install to permit the progress of the work including temporary pavements, fencing, access gates, and signs; demobilization of equipment; and the clean-up and restoration of the construction staging areas.

105-1.1 **Posted notices.** Prior to commencement of construction activities the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster “Equal Employment Opportunity is the Law” in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL “Notice to All Employees” Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

105-2 **Basis of measurement and payment.** Mobilization/Demobilization shall be measured for payment by the lump sum as a single complete unit of work. No additional measurement will be made should the Owner issue more than one (1) Notice to Proceed. No additional measurement will be made if a discontinuity in contract time occurs as a result of multiple Notices to Proceed. No additional measurement will be made should the Owner award any or all of the Additive Alternate Bids, if applicable. Mobilization/Demobilization shall not exceed five (5) percent of the total bid price for the base bid and/or for each of the additive alternative bids.

Based upon the contract lump sum price for “GP-105 Mobilization” partial payments will be allowed as follows:

- **a.** With first pay request, 25% provided that: 1) Contractor submittals required are provided to the satisfaction of the Engineer; 2) the Contractor’s Testing Laboratory is functional and testing equipment has been calibrated; 3) the Contractor’s Critical Path Method schedule has been submitted; 4) the Contractor’s Quality Control Program has been submitted for review; and 5) the Contractor has filed the applicable Permit Registration Documents required for the SWPPP.

- **b.** When 25% or more of the original contract is earned, an additional 25%.

- **c.** When 50% or more of the original contract is earned, an additional 40%.

- **d.** After Final Inspection, Staging area clean-up and delivery of all Project Closeout materials as required by 90-11, the final 10%.
If the price bid for Mobilization/Demobilization exceeds five (5) percent of the total bid for the base bid or the additive alternative(s) if applicable, any excess will be paid to the Contractor upon substantial completion of the project.

Payment will be made under:

- Item GP-105-2.1 Mobilization\Demobilization (Max 5% of Bid) – per lump sum

END OF SECTION 105
Section 110 Method of Estimating Percentage of Material Within Specification Limits (PWL)

110-01 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 (Sn) 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, QL for Lower Quality Index and/or QU for Upper Quality Index, is computed and the PWL for the lot for the specified n is determined from Table 1. All specification limits specified in the technical sections shall be absolute values. Test results used in the calculations shall be to the significant figure given in the test procedure.

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 level 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.

110-02 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:

\[ X = \frac{(x_1 + x_2 + x_3 + \ldots x_n)}{n} \]

Where: X = Sample average of all sublot values within a lot
x₁, x₂ = Individual sublot values
n = Number of sublots

e. Find the sample standard deviation (Sn) by use of the following formula:

\[ S_n = \sqrt{\frac{d_1^2 + d_2^2 + d_3^2 + \ldots d_n^2}{n-1}} \]

Where: \( S_n \) = Sample standard deviation of the number of sublot values in the set
d_1, d_2 = Deviations of the individual subplot values x_1, x_2, … from the average value X
that is: d_1 = (x_1 - X), d_2 = (x_2 - X) … d_n = (x_n - X)
n = Number of sublots

f. For single sided specification limits (that is, L only), compute the Lower Quality Index Q_L by use of
the following formula:

\[ Q_L = \frac{(X - L)}{S_n} \]

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 (that is, L and U), compute the Quality Indexes Q_L and Q_U by
use of the following formulas:

\[ Q_L = \frac{(X - L)}{S_n} \]
\[ Q_U = \frac{(U - X)}{S_n} \]

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. PWL 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% 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 Qₐ for the lot. (L=96.3)
Qₐ = (X - L) / Sn
Qₐ = (97.95 - 96.30) / 1.15
Qₐ = 1.4348

5. Determine PWL by entering Table 1 with Qₐ= 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 = (x₁ + x₂ + x₃ . . . n) / n
X = (5.00 + 3.74 + 2.30 + 3.25) / 4
X = 3.57%

3. Calculate the standard deviation Sₐ for the lot.
Sₐ = [(5.00 - 3.57)² + (3.74 - 3.57)² + (2.30 - 3.57)² + (3.25 - 3.57)²] / (4 - 1)¹/²
Sₐ = [(2.04 + 0.03 + 1.62 + 0.10) / 3]¹/²
Sₐ = 1.12

4. Calculate the Lower Quality Index Qₐ for the lot. (L= 2.0)
Qₐ = (X - L) / Sₐ
Qₐ = (3.57 - 2.00) / 1.12
Qₐ = 1.3992

5. Determine Pₐ by entering Table 1 with Qₐ= 1.41 and n= 4.
Pₐ = 97

6. Calculate the Upper Quality Index Qᵤ for the lot. (U= 5.0)
Qᵤ = (U - X) / Sₐ
Qᵤ = (5.00 - 3.57) / 1.12
Qᵤ = 1.2702
7. Determine $P_U$ by entering Table 1 with $Q_U = 1.29$ and $n = 4$.

$$P_U = 93$$

8. Calculate Air Voids PWL

$$PWL = (P_L + P_U) - 100$$

$$PWL = (97 + 93) - 100 = 90$$

**EXAMPLE OF OUTLIER CALCULATION (REFERENCE ASTM E178)**

**Project:** Example Project

**Test Item:** Item P-401, Lot A.

**A. Outlier Determination for Mat Density.**

1. Density of four random cores taken from Lot A arranged in descending order.
   - $A-3 = 99.30$
   - $A-4 = 98.35$
   - $A-2 = 97.55$
   - $A-1 = 96.60$

2. Use $n=4$ and upper 5% significance level of to find the critical value for test criterion $= 1.463$.

3. Use average density, standard deviation, and test criterion value to evaluate density measurements.

   a. For measurements greater than the average:
      
      If $(\text{measurement} - \text{average})/(\text{standard deviation})$ is less than test criterion,
      
      then the measurement is not considered an outlier.
      
      For $A-3$, check if $(99.30 - 97.95)/1.15$ is greater than 1.463.
      
      Since 1.174 is less than 1.463, the value is not an outlier.

   b. For measurements less than the average:
      
      If $(\text{average} - \text{measurement})/(\text{standard deviation})$ is less than test criterion,
      
      then the measurement is not considered an outlier.
      
      For $A-1$, check if $(97.95 - 96.60)/1.15$ is greater than 1.463.
      
      Since 1.435 is less than 1.463, the value is not an outlier.

**Note:** In this example, a measurement would be considered an outlier if the density were:

Greater than $(97.95 + 1.463 \times 1.15) = 99.63\%$

OR

less than $(97.95 - 1.463 \times 1.15) = 96.27\%$. 

### Table 1. Table for Estimating Percent of Lot Within Limits (PWL)

<table>
<thead>
<tr>
<th>Percent Within Limits (P_L and P_U)</th>
<th>Positive Values of Q (Q_L and Q_U)</th>
</tr>
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Percent Within
Limits
(PL and PU)
49
48
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46
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11
10
9
8
7
6
5
4
3
2
1

Negative Values of Q (QL and QU)
n=3

n=4

n=5

n=6

n=7

n=8

n=9

n=10

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-0.0725
-0.1087
-0.1447
-0.1806
-0.2164
-0.2519
-0.2872
-0.3222
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-0.3911
-0.4251
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-0.4916
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-0.7360
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-1.4700

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-2.0362

END OF SECTION 110

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Section 110 Method of Estimating Percentage of Material Within Specification Limits (PWL)


Part 2 – Earthwork

Item P-101 Surface Preparation

DESCRIPTION

101-1.1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable drawings.

EQUIPMENT

101-2.1 All equipment shall be specified here and in the following paragraphs or approved by the Engineer. The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of existing pavement.

a. Concrete pavement. The existing concrete pavement to be removed shall be freed from the pavement to remain by sawing through the complete depth of the slab one foot (30 cm) inside the perimeter of the final removal limits or outside the dowels, whichever is greater when the limits of removal are located on the joints. The pavement between the perimeter of the pavement removal and the saw cut shall be carefully broken up and removed using hand-held jackhammers, weighing 30 pounds (14 kg) or less, or other light-duty equipment which will not cause distress in the pavement which is to remain in place. The Contractor shall have the option of sawing through the dowels at the joint, removing the pavement and installing new dowels. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, then the perimeter shall be saw cut the full depth of the pavement. The Contractor shall have the option of sawing through the dowels at the joint, removing the pavement and installing new dowels. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, then the perimeter shall be saw cut the full depth of the pavement. The pavement inside the saw cut shall be removed by methods suitable to the Engineer which will not cause distress in the pavement which is to remain in place. If the material is to be wasted on the airport site, it shall be reduced to a maximum size designated by the Engineer. The Contractor’s removal operation shall not cause damage to cables, utility ducts, pipelines, or drainage structures under the pavement. Concrete slabs that are damaged by under breaking shall be removed. Any damage shall be repaired at the Contractor’s expense.

b. Asphalt concrete pavement. Asphalt concrete pavement to be removed shall be sawcut to the full depth of the bituminous material around the perimeter of the area to be removed. The pavement shall be removed by cold milling; no other removal method will be accepted. The resulting cold milled material shall be: 1) processed screened and re-used in the production of P-208 processed miscellaneous base and employed in the unpaved shoulder rehabilitation provided it meets the P-208 specification criteria; 2) hauled, spread and compacted to a maximum of 3” depth on the airport perimeter roads as shown on the Plans or as directed by the Engineer; and 3) if directed by the Engineer hauled, spread and compacted to a maximum of 3” depth on the haul roads. Any remaining or surplus cold milled material shall become the property of the Contractor and shall be disposed of off Airport property in accordance with Federal, state and local regulations. The Contractor shall make all arrangements for disposal of the surplus material at off-site locations as may be approved by the Engineer, and shall file with the Engineer the written consent of the owner of the property upon which he intends to dispose of such material prior to exporting the
material. If the material is to be used on the airport site (for the airport perimeter road or haul roads), it shall be broken to a maximum size of 1-1/2 (37.5) inches (mm).

**101-3.2 Preparation of joints and cracks.** Remove all vegetation and debris from cracks to a minimum depth of 1 inch (25 mm). If extensive vegetation exists treat the specific area with a concentrated solution of a water-based herbicide approved by the Engineer.

Cracks shall be prepared by one of the following methods:

1) Fill all cracks, ignoring hairline cracks (< 1/4 inch (6 mm) wide) with a crack sealer per ASTM D6690. Any excess joint or crack sealer on the surface of the pavement shall also be removed from the pavement surface.

2) Cracks and joints may be filled with a mixture of emulsified asphalt and aggregate. The aggregate shall consist of limestone, volcanic ash, sand, or other material that will cure to form a hard substance. The combined gradation shall be as shown in the following table.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4</td>
<td>100</td>
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<td>90-100</td>
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<td>No. 100</td>
<td>15-30</td>
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<tr>
<td>No. 200</td>
<td>10-20</td>
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Up to 3% cement can be added to accelerate the set time. The mixture shall not contain more than 20% natural sand without approval in writing from the Engineer.

The proportions of asphalt emulsion and aggregate shall be determined in the field and may be varied to facilitate construction requirements. Normally, these proportions will be approximately one part asphalt emulsion to five parts aggregate by volume. The material shall be poured or placed into the joints or cracks and compacted to form a voidless mass. The joint or crack shall be filled within 0 to 1/8 inches (0-3 mm) of the surface. Any material spilled outside the width of the joint shall be removed from the pavement surface prior to constructing the overlay.

**101-3.3 Removal of paint and rubber.** All paint over 1 foot (30 cm) wide that will affect the bond of the new overlay shall be removed from the surface of the existing pavement. High-pressure water (hydro-blasting) or cold milling may be used. Any methods used shall not cause major damage to the pavement. Major damage is defined as changing the properties of the pavement or removing pavement over 1/8 inch (3 mm) deep. Prior to beginning full-scale paint removal, the Contractor shall demonstrate to the Engineer the method and effectiveness of the removal process on a section of paint no less than 50 square feet (4.6 square meters). To be considered acceptable as determined solely by the Engineer, the process employed must remove the paint without leaving an objectionable shadow and without damaging the underlying pavement. The Engineer shall be the sole judge of the acceptability of the process. If chemicals are used, they shall comply with the state’s environmental protection regulations. No material shall be deposited on the runway shoulders. All wastes shall be disposed of off Airport property in accordance with Federal, State and local regulations.

**101-3.4 Concrete spall or failed asphaltic concrete pavement repair.**

a. **Repair of concrete spalls in areas to be overlaid with asphalt.** The Contractors shall repair all spalled concrete as shown on the plans or as directed by the Engineer. The perimeter of the repair shall be saw cut a minimum of 2 inches (50 mm) outside the affected area and 2 inches (50 mm) deep. The deteriorated material shall be removed to a depth where the existing material is firm or cannot be easily
removed with a geologist pick. The removed area shall be filled with asphaltic concrete with a minimum Marshall stability of 1,200 lbs (544 kg) and maximum flow of 20 (units of 0.01 in). The material shall be compacted with equipment approved by the Engineer until the material is dense and no movement or marks are visible. The material shall not be placed in lifts over 4 inches (100 mm) in depth. This method of repair applies only to pavement to be overlaid.

b. Asphaltic concrete pavement repair. The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. The base course and subbase shall be replaced if it has been infiltrated with clay, silt, or other material affecting the load-bearing capacity. Materials and methods of construction shall comply with the other applicable sections of this specification or as shown on the Plans.

101-3.5 Cold milling. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a finished surface that provides a good bond to the new overlay. The milling machine or grinder shall operate without tearing or gouging the underlaying surface. The milling machine or grinder shall be equipped with automatic grade and slope controls. The machine shall have the ability to remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of off Airport property, unless otherwise specified. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material that was removed with new material at no additional cost to the Owner.

a. Patching. The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The Contractor shall layout the area to be milled with a straightedge in increments of 1 foot (30 cm) widths for verification by the Engineer. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn’t have the appropriate milling machine, or areas that are damaged because of his negligence, shall not be included in the measurement for payment.

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of 7 feet (2 m) and it shall be equipped with electronic grade control devices that will cut the surface to the grade and tolerances specified. The machine shall cut vertical edges. A positive method of dust control shall be provided. The machine shall have the ability to remove the millings or cuttings from the pavement and load them into a truck.

c. Clean-up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual aggregate and fines are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow the surface to remove any remaining aggregate or fines.

101-3.6. Preparation of asphalt pavement surfaces. Existing asphalt pavements indicated to be treated with a surface treatment shall be prepared as follows:

a. Patch asphalt pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new asphalt concrete similar to that of the existing pavement in accordance with paragraph 101-3.4.

b. Repair joints and cracks in accordance with paragraph 101-3.2.

c. Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. After cleaning, treat these areas with an oil spot primer.

d. Clean pavement surface immediately prior to placing the surface treatment by sweeping, flushing well with water leaving no standing water, or a combination of both, so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.
101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the Engineer. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor’s expense.

101-3.8 Preparation of Joints in Rigid Pavement.

101-3.8.1 Removal of Existing Joint Sealant. All existing joint sealants will be removed by plowing or use of hand tools. Any remaining sealant and or debris will be removed by use of wire brushes or other tools as necessary. Resaw joints removing no more than 1/16 inch (2 mm) from each joint face. Immediately after sawing, flush out joint with water and other tools as necessary to completely remove the slurry. Allow sufficient time to dry out joints prior to sealing.

101-3.8.2 Cleaning prior to sealing. Immediately before sealing, joints shall be cleaned by removing any remaining laitance and other foreign material. Clean joints by sandblasting, or other method approved by the Engineer, on each joint face with nozzle held at an angle and not more than three inches (75 mm) from face. Following sandblasting, clean joints with air free of oil and water. Joint surfaces will be surface-dry prior to installation of sealant.

101-3.9.1 Preparation of Cracks in Flexible Pavement.

101-3.9.1 Preparation of Crack. Widen crack with router by removing a minimum of 1/16 inch (2 mm) from each side of crack. Immediately before sealing, joints will be blown out with a hot air lance combined with oil and water-free compressed air.

101-3.9.2 Removal of Existing Sealant. Existing sealants will be removed by routing. Following routing any remaining debris will be removed by use of a hot lance combined with oil and water-free compressed air.

METHOD OF MEASUREMENT

101-4.1 Pavement removal. The unit of measurement for pavement removal shall be the number of square yards (square meters) removed by the Contractor. Any pavement removed outside the limits of removal because the pavement was damaged by negligence on the part of the Contractor shall not be included in the measurement for payment.

101-4.2 Joint and crack repair. The unit of measurement for joint and crack repair shall be the linear foot (meter) of joint.

101-4.3 Paint removal. The unit of measurement for paint and rubber removal shall be the square foot (meter).

101-4.4 Spalled and failed asphaltic concrete pavement repair. NOT USED

101-4.5 Cold milling. The unit of measure for cold milling shall be per square yard (square meter). If the initial cut doesn’t correct the condition and surface correction is required, the Contractor shall re-mill the area and will be paid only once for the milling.

BASIS OF PAYMENT

101-5.1 Payment. Payment shall be made at contract unit price for the unit of measurement as specified above. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item.
Item P 101-5.1  Pavement Removal – per square yard
Item P 101-5.2  Joint and Crack Repair – per linear foot
Item P 101-5.3  Paint Removal – per square foot
Item P-101-5.4  Spalled and Failed Asphalitic Concrete Pavement Repair – NOT USED
Item P-101-5.5  Cold Milling – per square yard

MATERIAL REQUIREMENTS

ASTM D6690  Standard Specification For Joint And Crack Sealants, Hot Applied, For Concrete And Asphalt Pavements

END OF ITEM P-101
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New Item P-110  Contractor Quality Control

DESCRIPTION

110-1.1 General. This item shall consist of all work necessary to ensure quality control of the Contractor’s work during construction in accordance with Part I-General Provision Specification Section 100 and the Civil and Electrical Technical Specifications.

The Contractor shall be responsible to conduct all quality control testing, inspections, and reporting as indicated in the these Specifications, and for each pay item, as well as any other test, inspections and reporting not specifically listed, but necessary to adequately control the work to the satisfaction of the Engineer. The Engineer’s quality acceptance test results will be made available to the Contractor upon request. The Contractor shall not depend on the Engineer’s quality acceptance for the Contractor’s Quality Control Program.

The Contractor shall submit his plan for Quality Control Testing and Inspection as required in General Provisions, Section 100, for review and approval to the Engineer at least five (5) working days prior to the Pre-Construction Conference.

110-1.2 Construction Survey and Staking. The Contractor shall provide the appropriate construction survey and staking to establish lines and grades as necessary to permit satisfactory completion of the Contract work by the Contractor in accordance with the Contract Documents. This task shall also include but is not limited to the following: (i) providing all necessary data for the production and submittal of record/as-built drawings. The Contractor shall be responsible for production and submittal of all record drawings; and (ii) to provide all necessary as-built information to enable all final permits, inspections, sign-offs and certificates to be issued by all necessary jurisdictions.

110-1.3 Survey Control Verification. The item shall be carried out prior to setting any construction stakes, and shall include: firstly, the verifying of the accuracy of the control points established by the Engineer as shown on the Plans; and secondly, upon completion of this verification process, the Contractor’s registered Land Surveyor shall certify in writing, that all control points established by the Engineer are acceptable and adequate to allow the Contractor’s construction staking to meet the accuracy requirements of the specifications.

If errors are discovered during this verification process, and the control points do not agree with the geometry shown in the Plans, the Contractor shall immediately notify the Engineer in writing, explaining the issue in detail. The Engineer will advise the Contractor within five (5) working days of any corrective actions, which may be deemed necessary.

METHOD OF MEASUREMENT

110-2.1 Quality Control Plan. Measurement to be paid for development of the Contractor’s Quality Control Plan will be determined by the lump sum unit price.
110-2.2 Contractor Quality Control. Measurement for Contractor Quality Control to be paid for will be determined by the lump sum unit price.

110-2.3 Survey Control Verification. Survey control verification shall be measured for payment by the lump sum as a single complete unit of work.

110-2.4 Construction Survey And Staking. Construction Survey and staking shall be measured for payment by the lump sum as a single complete unit of work.

110-2.3 Computations For Contractor Monthly Pay Application. Monthly progress payments for the Contractor Quality Control and the Construction Survey and Staking will be calculated by dividing the lump sum unit price by the contract time in months.

BASIS OF PAYMENT

110-3.1 Contractor Quality Control Plan will be paid for at the lump sum price bid for developing the QCP. This lump sum price shall constitute full compensation for developing, submitting for review and addressing and incorporating all review comments, the Contractor’s Quality Control Plan.

110-3.2 Contractors Quality Control will be paid for at the lump sum price bid for the base bid and each additive alternate bid, (where listed in the Bid Proposal). Contractor Quality Control shall not exceed two (2) percent of the total bid price for the base bid and each additive alternate bid, (where listed in the Bid Proposal). This lump sum price shall constitute full compensation for furnishing all technicians, inspectors, testing equipment and field vehicles; for implementing the Contractor’s Quality Control Plan; and for all quality control testing, inspections, and reporting as indicated in the these Specifications, and for each pay item, as well as any other test, inspections and reporting not specifically listed, but necessary to adequately control the work to the satisfaction of the Engineer. All other labor, equipment, materials, tools and incidentals necessary to accomplish this item is to be included under item GP-105 Mobilization/Demobilization.

110-3.3 Survey Control Verification will be paid for at the lump sum price bid for the base bid. This lump sum price shall constitute full compensation for furnishing all technicians, surveyors and survey crews and equipment, and field vehicles; for all other labor, equipment, materials, tools and incidentals necessary to accomplish this work item for the base bid and all additive alternate bids.

110-3.4 Construction Survey and Staking will be paid for at the lump sum price bid for the base bid and each alternate bid, (where listed in the Bid Proposal). This lump sum price shall constitute full compensation for furnishing all technicians, surveyors, equipment, and field vehicles; for all other labor, equipment, materials, tools and incidentals necessary to accomplish this work item for the base bid and all additive alternate bids. Computations for Contractor monthly pay applications for progress payments will be calculated by dividing the lump sum unit price by the contract time in months.

Payment will be made under:

P-110-3.1 Quality Control Plan Development — per Lump Sum
P-110-3.2 Contractors Quality Control (Max 2%) — per Lump Sum
P-110-3.3 Survey Control Verification — per Lump Sum
P-110-3.4 Construction Survey and Staking — per Lump Sum

END OF ITEM P-110
New Item P-120 Pavement Saw Cutting

DESCRIPTION

120-1.1 GENERAL. This item includes saw cutting the existing pavement full depth, where new asphalt pavements are required to match existing asphalt pavements, and as indicated on the Plans. This item also includes clean-up of the pavement that is saw cut.

The existing pavement depths are shown at the pavement core locations on the Plans. The pavement cores show the approximate depth of the existing asphalt. The depths shown are representative of the depth at each specific core location only, and may not represent the depth between core locations.

Approximate lengths of saw cutting are shown on the Plans. The exact length of each saw cut will be laid out in the field by the Contractor and approved by the Engineer prior to performing the work. The Contractor shall perform each saw cut to the length required to complete the work.

CONSTRUCTION METHODS

120-2.1 Existing asphalt pavement to be milled or fully removed shall be saw cut by a device capable of making a neat, straight, smooth and vertical cut without damaging adjacent pavement that is not to be removed. The acceptability of the cutting device and manner of operation shall be to the satisfaction of the Engineer. Pavement saw cutting shall be required at match lines to existing pavement that is to remain.

Existing asphalt pavements that are to be matched shall be trimmed to a neat true line, with straight vertical edges free from irregularities using a saw specifically designed for this purpose. The Contractor shall protect the saw cut edge from damage until the finished surface has been completed. Edges which are damaged, in the opinion of the Engineer, shall be re-sawn the entire length of the matching joint prior to placing the finished surface.

Objects, surfaces, and items, including underground utilities designated to remain shall be carefully avoided and left undisturbed. Any damage to these items shall be the sole responsibility of the Contractor, and shall be repaired to the satisfaction of the Engineer at the Contractor’s sole expense.

The existing pavement shall be saw cut to coordinate with the proposed sequence of construction. The saw cut vertical edges shall be coated with bituminous tack coat immediately prior to constructing the new abutting bituminous surface course.

Full depth saw cutting is required where full-depth asphalt pavement removal is to be performed. Depth of full depth saw cuts varies by location.

Saw cutting is not required where asphalt pavement will be milled or pulverized, except as specifically called out in the plans or where the existing pavement to remain will be damaged by the pavement removal process. The Contractor should note that all pavement edges adjacent to milled or pulverized surfaces will be examined for smoothness and vertical line. If, in the opinion of the Engineer, the milled edge lacks sufficient smoothness and/or it is not a true vertical edge, the Contractor shall be required to trim said edges with a saw cut to meet the requirements of this section. No separate measurement or payment will be made for said saw cut.
METHOD OF MEASUREMENT

120-3.1 Full depth saw cutting shall be measured in linear feet of full depth saw cut performed, completed, and approved and only for the length as indicated on the plans.

BASIS OF PAYMENT

120-4.1 Payment for asphalt pavement saw cutting full depth shall be made at the unit price bid per linear foot of saw cut called for in the plans and shall be compensation in full for the completion of the saw cut including all labor, materials, equipment, and all incidentals necessary to perform the saw cutting.

Payment will be made under:

Item P-120-4.1 Saw Cut Full Depth — per liner foot

END OF ITEM P-120
New Item P-148 Airfield Construction Area Control

DESCRIPTION

148-1 General. This item shall consist of furnishing, installing, maintaining, adjusting, and removing construction signs, barricades, warning lights, lighted ‘X’s, and furnishing gate guards, flagging operations, furnishing, operating and maintaining sweepers and FOD Control, managing and providing all labor, equipment, and materials required to close the runway as required, and providing items as requested for safety and security at locations shown on the Plans, as specified in these Specifications, and as directed by the Engineer.

MATERIALS AND CONSTRUCTION REQUIREMENTS

148-2.1 Barricades. Barricades shall be placed at the locations shown on the Plans and/or as directed by the Engineer. Prior to starting work on each phase of the project, the Contractor shall prepare and submit a proposed barricade layout plan, barricade placement and removal schedule, and temporary storage location(s) for approval by the Engineer.

These additional requirements shall be followed:

a. Barricades required on all phases of the project shall be installed, maintained and repositioned as needed and as directed by the Engineer. Barricades shall only be in place while construction activities are underway and a portion of the taxiway or runway is closed to traffic other than construction activities. All barricades must be removed from traffic areas prior to opening those areas to traffic.

b. Barricades shall be positioned outside of the area of construction as shown on the Plans unless otherwise directed by the Engineer.

c. All barricades located outside the air operations area (AOA) and used for directing vehicular traffic shall be as approved by the Engineer for use in work zone traffic control.

d. Barricades shall be properly secured and inspected regularly by the Contractor to ensure that the barricades remain in-place and that all lights are operational. Inspections shall be conducted daily prior to the end of each shift allowing enough time for all barricades and lights to be repaired and fully operational at the end of the shift.

e. Barricades shall be spaced as outlined on the plans or as directed by the Engineer.

f. Barricades used on the airfield side of construction shall be Low Profile Type 1. The Contractor shall submit to the Engineer shop drawings or manufacture’s cut sheets for the specific barricade type that will be used, for review prior to ordering/purchasing the units and prior to use on the airfield.

g. Low Profile Type 1 barricades shall be of the 10-inch high x 96-inch long portable plastic water ballasted type equipped with reflective striping (on both sides) and flashing or steady burn battery or solar powered red lights. The Type 1 barricades shall be furnished in orange and white and be installed so that the colors alternate on adjacent barricades. Type 1 barricades shall be weighted with water to resist movement by jet blast. Each barricade shall have two lights.
h. Barricades used on the landside, adjacent to open roadways or as shown on the plans, shall be Caltrans Barricades, Type II.

i. All barricades shall remain the property of the Contractor and be removed from the Airport by the Contractor upon completion of the Work.

j. The Contractor shall maintain a 15 percent reserve in the number of barricades maintained at the project site. These reserve barricades shall be used by the Contractor only when and as directed by the Engineer or Airport Operations. No additional measurement or payment will be made for the maintenance and use of reserve barricades on the project site.

k. All maintenance work required to keep barricades, warning lights/ batteries, etc. in good operating condition shall be provided by the Contractor at the Contractor’s sole expense.

l. Contractor shall maintain barricades 24 hours a day and over non work periods. If more than two adjacent lights on the barricades fail the contractor shall immediately repair or replace the lights with operational units. Response times to calls concerning barricade maintenance shall be less than 20 minutes.

m. All unused barricade lights shall be turned off during daylight hours. Lights on barricades used during weekend closures shall be operating.

148-2.2 Barricade Lights. Flashing barricade lights shall be placed on each barricade. Barricade lights shall be in accordance with the current requirements of ITE Standards for Flashing and Steady Burning Warning Lights, Type A, as shown below:

<table>
<thead>
<tr>
<th>Warning Lights</th>
<th>Type A Low Intensity</th>
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<tbody>
<tr>
<td>Flashing Rate Per Minute</td>
<td>55 to 75</td>
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<tr>
<td>Flash Duration&lt;sup&gt;1&lt;/sup&gt;</td>
<td>10%</td>
</tr>
<tr>
<td>Minimum Effective Intensity&lt;sup&gt;2&lt;/sup&gt;</td>
<td>5 Candles</td>
</tr>
<tr>
<td>Minimum Beam Candle Power&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-----</td>
</tr>
<tr>
<td>Hours of Operations</td>
<td>Dusk to Dawn</td>
</tr>
<tr>
<td>Diameter of Lens</td>
<td>2.5 inches Minimum</td>
</tr>
</tbody>
</table>

<sup>1</sup> Length of time that instantaneous intensity shall be equal to or greater than effective intensity.

<sup>2</sup> These values shall be maintained within an angle of 9 degrees on each side of the vertical axis and 5 degrees above and below the horizontal axis.

Barricade lights shall be solar or battery-operated and be housed in a weatherproof enclosure. Lights shall be equipped with a solar switch which shall turn the light on at dusk and off at dawn. All barricade lights used on the AOA shall be red.

Barricade lights shall be secured to the constructed signs, barricade or support by tamper-proof bolts.

148-2.3 Lighted ‘X’ runway closure signals.

The Owner will make two lighted ‘X’ runway closure signals available for use by the Contractor for the duration of the project. In addition to the Owner provided units the Contractor shall furnish the required number of Lighted ‘X’ runway closure signals as identified on the plans. The Contractor provided runway closure signals shall meet the requirements of AC 150/5345-55 and the requirements as shown on the plans. The Lighted ‘X’ runway closure signals shall be mobile units with trailer hitches to accommodate ease of movement and set-up.
Prior to each runway closure the Contractor shall position and set-up the lighted ‘X’ runway closure signals at the locations shown on the plans or as directed by the Engineer. The maintenance and servicing of the lighted ‘X’ runway closure signals provided by the Owner shall be the responsibility of the Contractor. Maintenance and servicing includes, but is not limited to, providing fuel, checking fuel and fluid levels, and repairing / replacing non-functioning bulbs. The Contractor shall set up and remove the lighted ‘X’ runway closure signals at the start and end of each runway closure only after receiving approval to occupy the runway or approval to open the runway is granted by the Airport. This approval process shall govern the set up and removal of the lighted ‘X’ runway closure signals for all work, including the extended closures and the nightly closures.

148-2.4 Contractor Haul Routes. All Contractor’s haul routes shall be clearly marked with traffic cones, traffic barricades with yellow flashing lights, and other traffic control devices, as shown on the Plans or as directed by the Engineer. Prior to starting work on each phase of the project, the Contractor shall prepare and submit a proposed haul route layout and marking plan that he intends to use for the particular phase for approval by the Engineer. All haul route layout and marking plans must be approved by the Engineer prior to the start of the work. Haul route cones shall only be in place while construction activities are underway. The Contractor shall set up the cones at the beginning of each work period and take them down prior to the end that period.

148-2.5 Gate Guards. The Contractor shall furnish trained gate guards at the entrances to the AOA whenever these entrances are in use by the Contractor. All gates guards shall be required to obtain Air Operations Area (AOA) security training.

All Airport perimeter gates (new and/or existing) that are used by the Contractor for access to the AOA and are designated a controlled access gate shall require a gate guard at all times the gate is in use. The controlled access gate shall be closed and locked (with a lock provided by the Contractor) during off-hours, when construction is not in progress, and when the gate guards are not at the station. The Contractor shall be responsible for controlling access through the controlled access gate by means of a manual barrier gate with minimum 16-foot arm. All gate guards shall have communications equipment in the form of local area code cell phones for direct communications with Airport personnel should any problems or questions arise.

A minimum of one gate guard shall be provided at each AOA controlled access gate. Guards shall review and log in each person and vehicle entering the AOA recording the time of entry and exit. Guards shall check the equipment and vehicles entering the AOA.

148-2.6 Flagging. The Contractor shall furnish competent, trained and adequately equipped flagging personnel during construction working hours to maintain a safe flow of construction and non-construction traffic. Flaggers shall be positioned on each side of any active aircraft movement area crossing to clear equipment across the movement areas when no aircraft traffic is present. Flaggers shall be responsible for direct communications and monitoring of air traffic on Common Traffic Advisory Frequency (CTAF), frequency and indirect communications in the form of local area cell phones with Airport personnel. When approved by the Airport, flaggers shall annoyance for any construction traffic needing to cross the active movement areas in either direction. Flaggers shall at all times monitor CTAF frequency communications in order to monitor aircraft movements. All Flaggers shall be training in - and familiar with - the Aeronautical Information Manual Chapter 4, Section 2 concerning aircraft Radio Communications Phraseology and Techniques with an operating non-tower airport.

Aircraft traffic and other airport vehicles shall be given priority and have the right-of-way at all times. Construction equipment shall be held at the Taxiway Object Free Area (OFA) limits for Group II aircraft (130-feet) and the Runway Obstacle Free Zone (OFZ) while aircraft approach and pass. Flaggers shall not permit construction vehicles and/or equipment to enter the Taxiway OFA or Runway OFZ without an assured exit. Flaggers shall not permit construction vehicles and/or equipment to enter the Taxiway OFA
or Runway OFZ when an aircraft is approaching and within 500-feet of the controlled crossing. Construction vehicles, equipment or personnel shall not be permitted to park, stall or idle within the Taxiway OFA or Runway OFZ and shall expedite crossing of all active movement areas.

148-2.7 Vehicle Monitors. All vehicles operating in the AOA must be properly marked and lighted in accordance with the requirements for marking and identifying vehicles identified in AC 150/5210-5 (latest edition), Painting, Marking, and Lighting of Vehicles Used on an Airport. All vehicles operating in the AOA must be equipped with a properly trained driver; a properly trained driver is defined as an individual who has attended the Airport security and airfield driver training. Any vehicles operating on the Airport without a properly trained driver shall be under the direct escort of a vehicle monitor. Vehicle monitors shall move about the project site to make sure that all construction traffic is operating within designated areas. Vehicle monitors shall comply with the following criteria:

- Possess a valid State of California driver’s license,
- Attend the Airport security and airfield driver training
- Monitor’s vehicle shall be clearly marked with the company name and logo, and lighted in accordance with AC150/5210-5
- Attend operations and communications training provided by Airport Operations
- Attend all project pre-phasing meetings and all contractor’s safety meetings

The Contractor shall provide the number of monitors required to adequately monitor areas under construction and all haul routes. The Contractor should also note that the more spread-out the construction activities are, the more monitors will be necessary to provide adequate coverage. If at any time, at the Engineer’s sole determination, the Contractor is not providing sufficient monitoring of the work areas, the Engineer shall require that additional monitors be provided by the Contractor at the Contractor’s sole expense. Adequate, sufficient monitoring shall be considered control maintained of all workers within the designated work areas with zero infractions of open airfield surfaces.

148-2.8 Fod Control And Sweeper(S). Foreign Object Debris (FOD) is a serious concern on an active airfield. Substances, debris or articles alien to an aircraft vehicle or system, and construction debris, waste and loose material that has potential to cause damage to aircraft or being ingested by jet engines, is not allowed on the active aircraft movement areas of the Airport. Loose trash, construction debris, aggregate, soil or other construction material, small pebbles, etc. on the pavement areas open to aircraft traffic is unacceptable. As such, the Contractor shall eliminate the potential for any FOD by maintaining a clean work area and continually patrolling the project areas removing any FOD generated, or any material that could cause the generation of FOD. The Contractor shall immediately remove FOD found on the pavement areas open to aircraft traffic, and the sweeping operation shall be maintained continuously during construction operations. FOD removal shall also be carried outside the construction work times as required to ensure the pavement areas open to aircraft traffic remain free of FOD generated from the construction activities.

The Contractor shall provide for a minimum of: one (1) operational primary sweeper including an operator assigned solely to the sweeper, at all times during construction activities; and one (1) back-up sweeper capable of arriving at the airport within thirty (30) minutes if required. All sweepers shall be Tymco® model 600 heavy-duty sweepers with high speed power head, or Elgin model crosswind. The back-up sweeper shall be of similar type and power as the primary sweeper; it shall serve: 1) in case the primary sweeper is taken out of service due to maintenance issues or mechanical malfunction; or 2) if, as deemed necessary by the Engineer, supplement FOD control is required by the extent of the construction activities in progress at a given time. No additional payment shall be made for the back-up sweep, it shall be considered a subsidiary obligation of the Contractor covered under the sweepers and fod control pay item.
The sweeping operation shall maintain all haul routes in a clean condition with no tracking of material onto or around the movement and non-movement areas within the AOA. All sweepers shall be in indirect communications (in the form of cell phones or two-way construction radios) with the Contractor’s superintendent at all times for receiving instructions on areas requiring immediate attention.

The sweeper operation shall be supplemented by hand sweeping in areas not accessible to the sweeper as required, or if deemed necessary by the Engineer.

148-2.9 Safety. The Contractor shall follow the guidelines and procedures contained in Federal Aviation Administration Advisory Circular 150/5370-2 (latest edition) “Operational Safety on Airports During Construction” (included in Appendix A); and other applicable Sections of these Specifications.

The Contractor shall acquaint its supervisors and employees of the Airport activity and operations that are inherent to this active Airport and shall conduct its construction activities to conform to all routine requirements and emergency air traffic requirements and guidelines on safety specified in these Specifications.

All vehicles that are authorized to operate on the Airport shall display in full view above the vehicle, a 3-foot x 3-foot or larger, orange and white checkerboard flag, each checkerboard color being 1-foot square. Any vehicle operating in the active AOA during the hours of darkness shall be equipped with a flashing amber (yellow) dome light, mounted on top of the vehicle and of such intensity to conform to local codes for maintenance and emergency vehicles.

No runway, taxiway, apron or airport roadway shall be closed without written approval of the Airport. The Airport will issue “Notices to Airmen” (NOTAM) and other necessary advisories to airport services or tenants. The Contractor shall provide a minimum of 72 hour notice of the requested closing to the Engineer, who will coordinate the request with Airport Operations.

Open-flame welding, torch-cutting operations, and smoking shall be prohibited within the AOA. All vehicles are to be parked and serviced behind the building restriction line or in an area designed by the Engineer.

Open trenches, excavations, and stockpiled material at the construction site shall be prominently marked with low profile barricades during hours of restricted visibility/darkness. Under no circumstances are flare pots to be used.

Stockpiled material shall be constrained in a manner to prevent movement resulting from aircraft blast or wind conditions. Material should not be stored near aircraft turning areas or movement areas.

Debris, waste and loose material capable of causing damage to aircraft or being ingested in jet engines is not allowed on active aircraft movement areas. The Contractor shall remove said material immediately.

148-2.10 Security. Contractor shall comply with all security requirements specified herein and comply with all applicable Federal safety and security regulations. The Contractor shall appoint and designate to the Engineer in writing the name of its Chief of Security. The Chief of Security shall represent the Contractor on the safety and security requirements of the project.

The Airport is operated in strict compliance with Federal Aviation Regulations, which prohibits unauthorized persons or vehicles in the AOA. Equipment and personnel will be restricted to the work area defined on the plans. Any violations by Contractor’s or Subcontractor’s personnel will subject the Contractor to penalties imposed by the FAA and the Airport.
The Contractor shall comply with all security requirements specified herein.

Access to the Site. The Contractor’s access to the site shall be as shown on the Plans (designated Controlled Access Gate). No other access points shall be allowed. All access points shall be secured (i.e. locked gate) or manned by a Contractor provided gate guard. All manned access points shall have a physical barrier that must be moved or otherwise operated by the gate guard to allow vehicles to pass through the access point. Contractor traffic authorized to enter the site shall be escorted by Contractor personnel in accordance with these Specifications, and the FAA Advisory Circular 150/5370-2 (latest edition), and Airport’s “Airport Operational Safety and Security Requirements” and other security instructions included elsewhere herein. The Contractor shall maintain traffic control to and from the various areas of the Work. The Contractor shall immediately clean any debris deposited along any route used through the paved areas of the airport as a result of its construction traffic. Directional signing at the access point and along the delivery route to the storage area or Work site shall be as directed by the Engineer.

The Contractor must maintain a sign-in sheet, kept on a daily basis, recording the names and company of all construction personnel working on, delivering to or visiting the job site. A copy shall be given to Airport and the Engineer each day.

Materials Delivered to the Site. Delivery vehicles for Contractor’s material orders shall be escorted by the Contractor’s vehicle monitors to the delivery site.

Identification – Contractor Provided Escorts. All Contractor provided escorts and construction personnel operating a vehicle or self-propelled construction equipment within the AOA, including Subcontractors assigned to the project shall attend the Airport’s drivers training. The Contractor shall provide the number of escorts required to adequately escort the number of personnel working within the AOA during the construction. Escorts shall be limited to a maximum of eight individuals under escort at any one time. All escorted individuals shall remain in close proximity to their escort at all times.

In addition, the following personnel shall be required to attend the Airport’s drivers training: all gate guards, all flaggers, the Contractor’s superintendent and assistant superintendent.

The Contractor’s superintendent and assistant superintendent, will be responsible for assuring that no breeches of the Airport safety and security program occur. Escorted vehicles shall not be left unattended by the Contractor’s escorts.

Each person or vehicle entering the AOA under the escort of the Contractor shall carry the full coverage of liability and property damage.

Identification – Escorted Personnel. The Contractor shall maintain a master list of construction personnel working within the AOA under escort and it shall be made available for the Airport’s examination at any time.

All construction personnel in the AOA shall wear a uniform shirt/jacket and hard hats that will clearly identify them as being construction personnel authorized to work in and have access to the AOA.

Identification – Vehicles. The Contractor, through the Contractor’s Chief of Security, shall establish and maintain a list of vehicles authorized to operate on the Airport. Vehicles delivering materials to the construction site shall sign-in with the Contractor’s gate guard personnel. Contractor’s personnel operating vehicles and/or equipment within the AOA shall complete a driver training class presented by the airport to familiarize them of the allowable haul routes, speed limits, non-movement areas, and open airfield areas.

The personal vehicles of Contractor’s employees are not allowed on the airfield at any time, the Contractor shall ensure that adequate off-site parking is available.
The Contractor shall be responsible for the protection of the construction site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons. Security measures shall include such additional security fencing, barricades, lighting, and other measures as the Contractor may deem necessary to protect the site.

**148-2.11 Runway Closures.** Contractor shall coordinate all runway closure needs with the Engineer and the Airport. Closures shall be identified on the contractor’s CPM construction schedule and all look ahead schedules. In addition, a minimum of 72 hours prior notification is required to be provided to Airport for all runway closures. No closure shall commence until approved by the Airport.

Runway closures are required for all work to be performed within the Runway Safety Area (RSA). No work shall be allowed within the RSA without a runway closure.

**Full Runway Closures:** This type of closure requires the contractor to close Runway 13-31 and Runway 6-24 for the duration of the work within the RSA. Closure activities shall include setting up runway closure Lighted ‘X’ signals at the both ends of the runway, and coordinating the de-energizing of all runway edge lighting and signage systems and runway visual aids. Maintenance and fueling of the Lighted ‘X’ signals shall be the responsibility of the Contractor.

**Runway Nightly Closures:** This type of closure requires the contractor to close Runway 13-31 or Runway 6-24 nightly for the night-time closure period identified on the plans to permit work within RSA, the 14 CFR Part 77 imaginary surfaces, and the approach and departure surfaces. Closure activities shall include setting up runway closure Lighted ‘X’ signals at the both ends of the runway and coordinating the temporary de-energizing of all runway approach lighting and edge lighting systems. Maintenance and fueling of the Lighted ‘X’ signals shall be the responsibility of the Contractor.

**148-2.12 Opening Inspections.** When the Contractor requests to open an individual phase of work, or a closed runway that is scheduled to be re-opened to aircraft traffic, the Engineer and Airport will conduct an inspection of each construction area before allowing the closed area to be opened to aircraft traffic. The conditions which the Engineer shall consider potentially hazardous and which must be corrected prior to reopening the runway include but are not limited to, the following:

a. Trenches, holes, or excavations, mounds or piles of earth, temporary stockpiles, construction materials, temporary structures, or other objects within the Runway ORZ.

b. Un-marked or un-lighted holes, trenches or excavations near any Runway OFZ.

c. Mounds or piles of earth, temporary stockpiles, construction materials, temporary structures, or other objects on or in the vicinity of any open runway or taxiway object free area.

d. Vehicles or equipment (whether operating or idle) on any open apron, taxiway, or in any related safety.

e. Vehicles, equipment, excavations, stockpiles, or other materials which could impinge upon Navigational Aid (NAVAID) critical areas and degrade or otherwise interfere with electronic signals from radios or electronic NAVAIDs or interfere with visual aid facilities.

f. Objects (whether marked/flagged or not) or activities anywhere on or in the vicinity of the airport which could be distracting, confusing, or alarming to pilots during aircraft operations.

g. Un-flagged or un-lighted construction vehicles and equipment in the vicinity of an active runway, taxiway or apron.

h. Misleading or malfunctioning obstruction lights or barricade lights.

i. Inadequate, confusing, or misleading (to user pilots) marking/lighting of any open apron, runway, taxiway, or in any related safety, approach or departure area.
j. Water, dirt, debris, or other transient accumulation that temporarily obscures pavement marking, pavement edges, or derogates the visibility of runway/taxiways marking, lighting or of construction and maintenance areas. There is zero tolerance for foreign object debris.

k. Inadequate or improper methods of marking, barricading, or lighting of temporarily closed portions of the AOA including unlighted or missing construction and barricade lights.

l. Construction materials, trash or other materials with FOD potential, whether on aprons, runways, taxiways, service road, public streets or related safety areas. The Engineer will be watchful for FOD that can be ingested into aircraft engines. Such items include rock, aggregate, soil, loose polyethylene and other light materials capable of being blown onto aircraft movement areas by wind.

m. Construction/maintenance activities or materials that could hamper Airport Rescue and Fire-Fighting (ARFF) vehicle access to all parts of the runway/taxiway system, runway approach and departure areas, or aircraft parking locations.

n. The time allowances for all work is inclusive of the Contractor moving onto the site, performing work activities, performing all clean-up, having the work area and haul routes inspected and approved by the Engineer, and moving off the site. The Contractor shall provide adequate lighting in the opinion of the Engineer, for the needs of the inspection personnel.

o. A Runway does not pass inspection must remain closed until such time cleanup is performed and approved by the Engineer and accepted by the Airport. The official "Opening Time" will be that time when the temporary runway closure signals are removed from the RSA.

148-2.13 Maintenance of Temporary Facilities. The Contractor shall conduct inspections of temporary runway and taxiway edge lights and airfield signs, runway visual aids, and the low profile barricades in use prior to the end of each shift allowing enough time for all barricades, signs and lights to be repaired or replaced if items are found to be not functioning properly. The Contractor shall ensure all temporary facilities are fully operational and acceptable to the Engineer at the end of each shift.

148-2.14 Safety Plan Compliance Document (SPCD). The Contractor shall develop and submit for review and approval by the Engineer and Airport, a Safety Plan Compliance Document prior to the pre-construction conference. The Contractor’s SPCD shall comply with the specific safety and security requirements of the Contract Documents, and shall comply with the FAA Advisory Circular 150/5370-2 (latest edition) “Operational Safety on Airports during Construction”. In developing the SPCD the Contractor shall be responsible for analyze the planned methods of operation, incorporate any additional specific or unique safety requirements, and ensure that all applicable safety regulations are addressed. The Contractor’s SPCD shall be project specific and include but not be limited, to the following:

General Provisions

a) Acknowledgement of Responsibilities during the construction work.
b) Safety and Managerial Personnel; including Contractor points of contact, titles, roles and 24/7 contact information.
c) Compliance; Contractor’s plan to comply with the specific safety requirements of the Contract Documents.
d) Site Layout.
e) Overview and commitment to weekly safety meetings.
f) Traffic Control.
g) Safety Requirements; Testing and inspection of equipment and the provision for backup alarms for mobile equipment.

Special Provisions

a) Excavations: The Contractor shall include his plan for performing the excavation work in accordance with OSHA (Occupational Safety and Health), Cal/OSHA (California Division of Occupational Safety and Health), and other applicable statutes or regulations;
this shall include addressing permanent and temporary slope angle and protection, shoring, guarding, barricades, excavation access, and excavated material storage.

b) Cranes: The Contractor shall address the requirement and use of cranes or derricks and the testing and inspection thereof, including hook latches, cables, boom stops, load tables, warning devices, fire extinguishers, and where the illustration of crane operation signals shall be posted on the job site.

c) Fall Arresting: The Contractor shall address the requirement and use of employ full-body harnesses, life lines, and lanyards when necessary.

d) Hazard Communication Program: The Contractor shall instigate a policy for following hazard communications program.

e) Lockout/Tagout: The Contractor shall address the employment of the Airport’s Lockout/Tagout procedures for the control of electrical energy during work operations.

f) Disciplinary Program: The Contractor shall address the requirement to instigate a Disciplinary Program for safety violations.

g) Signage: The Contractor shall address the requirement to install signs that are clearly visible from 50 feet that identify any hazardous or dangerous conditions. Hazard signs must be red with white lettering.

h) Job Hazard Analysis Program: As part of the Safety Plan Compliance Document the Contractor shall submit for review, a Job Hazard Analysis Program that identifies any work activities which pose a potential safety hazard. This program shall be documented into definable and manageable components whenever the risk of personal injury exists.

AOA Specific

a) The Contractor shall identify and provide the necessary plans shown the following: vehicle parking, temporary pavement markings, temporary airfield and non airfield lighting, and flagging locations.

b) Height Restrictions: The Contractor shall address the limitations and restrictions on equipment and material height identified in the Contract Documents.

c) AOA Security: The Contractor shall provide security and gate control procedures and points of contact.

d) The Contractor shall identify CTAF Radio communication equipment contact roles and responsibilities.

e) The Contractor shall address the procedures, responsibilities and timing associated with opening and closing Runway 10R-28L and other movement areas of the airport.

f) The Contractor shall include the procedures for managing subcontractor access, driver training and other AOA safety and security requirements.

g) The Contractor shall include the formalized process for monitoring local aircraft operations and how to respond in an emergency or unexpected aircraft operation.

h) The Contractor shall develop and include an operations, movements, access and barricade plan by Project Phase and Schedule.

i) The Contractor shall address the requirement to instigate a positive means of FOD control and elimination.

j) The Contractor shall include provisions for instigating: 1) a training program for all site personnel; and 2) a review process to ensure compliance.

METHOD OF MEASUREMENT

148-3.1 Airfield Construction Area Control. Airfield Construction Area control shall be measured by the lump sum and shall include the Contractor developing and submitting for review a “Safety Plan
Compliance Document”, and for furnishing, installing, removing, storing, maintaining, and reinstalling as needed, barricades, cones, barricade lights; for providing trained Vehicle Monitors, flaggers, gate guards, and Contractor provided escorts; for providing sufficient number of airfield transceiver radios for communicating on CTAF frequencies; for instituting a safety and security system to ensure the integrity of the airport security is maintained; for installing temporary vehicle traffic control pavement markings; for furnishings the Contractor’s airfield radios; and for all other trained personnel to provide the requirements of this item.

148-3.2 Sweeper and FOD Control. Sweeper for FOD Control shall be measured by the calendar day (based on 24 hour day) for the primary sweeper employed on which the sweeper proceeded with FOD control and airfield pavement sweeping work for at least 6 hours out of the 24 hours toward completion of the contract. This price shall include furnishings, maintaining, and operating sweepers and conducting regular FOD checks. Sweeping operations that do not meet the minimum 6 hours of operation within a 24 hour day shall be considered incidental to the project and no payment shall be made therefor. No separate measurement or payment shall be made for the back-up sweeper it shall be considered a subsidiary obligation of the Contractor paid for under the other contract items.

148-3.3 Contractor provided airfield transceiver radios will not be measured or paid for separately, they shall be considered a subsidiary obligation of the Contractor paid for under the other contract items.

BASIS OF PAYMENT

148-4.1 Payment for airfield construction area control, including furnishing installing, removing, storage, maintenance, and reinstalling, as needed, barricades, runway closure markings, cones, barricade lights, providing trained vehicle monitors, flaggers, gate guards, Chief of Security, temporary vehicle traffic control pavement markings, and all other trained personnel to provide the requirements of this item shall be made at the lump sum price bid. The price bid shall be full compensation for furnishing all materials, and for all labor, equipment, tools, and incidentals necessary to complete construction safety and security. Partial payments for construction safety and security under this item will be made in accordance with the following provisions:

a. The first partial payment for airfield traffic control will be made at 25-percent of the lump sum price bid, at such time that: 1) the project submittals required (P-401 Job Mix Formula, Contractor’s Quality Control Plan, project CPM schedule, SWPPP) are provided and to the satisfaction of the Engineer; 2) the barricades have been delivered to the Work Site; and 3) Contractor’s personnel have received all necessary security driver and operations training from the Airport as defined in these Specifications.

b. The remaining partial payments for construction safety and security will be made on each monthly progress pay at a rate of 75-percent of the lump sum price bid divided by the number of months established for the duration of the Work.

148-4.2 Sweepers for FOD Control shall be paid for per the contract unit price per day and shall include furnishing, maintaining, operating the required number of operational sweepers plus any backups and conducting regular FOD checks. Payment shall be based on satisfactory compliance with the SPCD. Failure to maintain the required number of sweepers and adequately clean the area may cause the Airport to furnish a sweeper and operator(s) and deduct the cost from the amounts due on the following pay application.

Payment will be under:
Item P-148-4.1  Airfield Construction Area Control – per Lump Sum.
Item P-148-4.2  Sweepers and FOD Control – per Calendar Day

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Item P-151 Clearing and Grubbing

DESCRIPTION

151-1.1 This item shall consist of clearing or clearing and grubbing, including the disposal of materials, for all areas within the limits designated on the plans or as required by the Engineer.

   a. Clearing shall consist of the cutting and removal of all trees, stumps, brush, logs, hedges, the removal of fences and other loose or projecting material from the designated areas. The grubbing of stumps and roots will not be required.

   b. Clearing and grubbing shall consist of clearing the surface of the ground of the designated areas within the grading limits as shown on the plans of all top soil, asphalt millings, rip rap, trees, stumps, down timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences, structures, debris, and rubbish of any nature, natural obstructions or such material which in the opinion of the Engineer is unsuitable for the foundation of strips, pavements, or other required structures, including the grubbing of stumps, roots, matted roots, foundations, and the disposal from the project of all spoil materials resulting from clearing and grubbing.

CONSTRUCTION METHODS

151-2.1 General. The areas denoted on the plans to be cleared or cleared and grubbed shall be staked on the ground by the Contractor for verification by the Engineer. The clearing and grubbing shall be done at a satisfactory distance in advance of the grading operations.

All spoil materials removed by clearing or by clearing and grubbing shall be disposed of outside the Airport’s limits at the Contractor’s responsibility, except when otherwise directed by the Engineer. As far as practicable, waste concrete and masonry shall be placed on slopes of embankments or channels. When embankments are constructed of such material, this material shall be placed in accordance with requirements for formation of embankments. Any broken concrete or masonry that cannot be used in construction and all other materials not considered suitable for use elsewhere, shall be disposed of by the Contractor. In no case shall any discarded materials be left in windrows or piles adjacent to or within the airport limits. The manner and location of disposal of materials shall be subject to the approval of the Engineer and shall not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the airport property limits, the Contractor shall obtain and file with the Engineer permission in writing from the property owner for the use of private property for this purpose.

Blasting shall not be allowed.

The removal of existing structure and utilities required to permit orderly progress of work shall be accomplished by the Contractor, unless otherwise shown on the plans. Whenever a telephone or telegraph pole, pipeline, conduit, sewer, roadway, or other utility is encountered and must be removed or relocated, the Contractor shall advise the Engineer who will notify the proper local authority or owner prior to any work being performed on the relocation.

151-2.2 Clearing. The Contractor shall clear the staked or indicated area of all objectionable materials. Trees unavoidably falling outside the specified clearing limits must be cut up, removed, and disposed of in a satisfactory manner. To minimize damage to trees that are to be left standing, trees shall be felled toward the center of the area being cleared. The Contractor shall preserve and protect from injury all trees
item P-151 clearing and grubbing

not to be removed. The trees, stumps, and brush shall be cut flush with the original ground surface. The grubbing of stumps and roots will not be required.

Fences shall be removed and disposed of as directed by the Engineer. Fence wire shall be neatly rolled and the wire and posts stored on the airport if they are to be used again, or stored at a location designated by the Engineer if the fence is to remain the property of a local owner or authority.

151-2.3 clearing and grubbing. in areas designated to be cleared and grubbed, all stumps, roots, buried logs, brush, grass, and other unsatisfactory materials shall be removed, except where embankments exceeding 3-1/2 feet (105 cm) in depth will be constructed outside of paved areas. For embankments constructed outside of paved areas, all unsatisfactory materials shall be removed, but sound trees, stumps, and brush can be cut off flush with the original ground and allowed to remain. Tap roots and other projections over 1-1/2 inches (38 mm) in diameter shall be grubbed out to a depth of at least 18 inches (0.5 m) below the finished subgrade or slope elevation.

Any buildings and miscellaneous structures that are shown on the plans to be removed shall be demolished or removed, and all materials shall be disposed of by removal from the site. The cost of removal is incidental to this item. The remaining or existing foundations, wells, cesspools, and like structures shall be destroyed by breaking down the materials of which the foundations, wells, cesspools, etc., are built to a depth at least 2 feet (60 cm) below the existing surrounding ground. Any broken concrete, blocks, or other objectionable material that cannot be used in backfill shall be removed and disposed of at the Contractor’s expense. The holes or openings shall be backfilled with acceptable material and properly compacted.

All holes under embankment areas remaining after the grubbing operation shall have the sides of the holes flattened to facilitate filling with acceptable material and compacting as required in Item P-152. The same procedure shall be applied to all holes remaining after grubbing in areas where the depth of holes exceeds the depth of the proposed excavation.

151-2.4 salvaged items. Items designated to be salvaged shall be delivered to the Owner at a location defined by the Engineer, based on the type of item salvaged. Items which are defined to be reused in the construction, which are damaged or destroyed as a result of the Contractor’s operations, shall be replaced in kind with new materials at the Contractor’s sole expense. The Contractor shall take care to protect all salvaged materials delivered to the Owner from damage so that they may be reused. The Contractor shall salvage all existing airfield lighting and signage fixtures and transformers that are identified to be removed.

151-2.5 survey monument restoration. At the beginning of the Work and prior to any demolition or pavement cold milling work, the Contractor shall photograph and survey the location of all existing survey monuments (both Airport and FAA ground check markers) within the Work area as well as all runway end survey markers/points. The Contractor shall furnish the Engineer with an Existing Survey Monument summary report that includes: monument photos, surveyed location data, type of monument, and inscription data. Upon completion of construction activities the Contractor shall install new survey monuments to replace those destroyed during construction and to replace the runway end markers/points. Replacement of all survey monuments/markers will be not paid for separately; the work covered by this section shall be considered as a subsidiary obligation of the Contractor covered under the other contract items. Monuments located outside the limits of grading are to remain in-place and be protected from damaged by the Contractor. Replacement of all Contractor damaged or destroyed monuments located outside the limits of grading will be at the Contractor’s sole expense. All survey work shall comply with the requirements of Subsection 50-06 “Construction Layout and Stakes.”

New monuments (other than the FAA ground check markers and runway end points) shall be of the same size and type as those that were removed/damaged. The runway end markers shall be bronze survey marker set in 6-inch diameter 2’-2” deep P-610 concrete footing as shown on the Plans. All runway
markers shall be set flush with the finished pavement and shall be stamped with the LS/RCE number, the applicable runway end designation, and the Lat/Long value. In the event that more than one size or type of monument must be replaced, the Owner may direct the Contractor to make all new Airport monuments of the same size and/or type. No additional payment will be made for changes to the type or size of monuments to be installed.

All new monuments and runway end markers shall be installed at the same horizontal location as the monuments being replaced. The elevation and horizontal location of each new monument shall be surveyed, by the Contractor’s State of California registered professional land surveyor, and included on the monument’s inscription. The inscription on each new monument will be of the type used on the monuments that are being replaced.

In addition to the criteria identified on the Plans and upon completion of the new monument/marker installation, the Contractor shall furnish the Engineer with a New Survey Monument/Marker summary report that includes: monument photos, surveyed location data, type of monument, and inscription data for each new monument installed; and a survey cad file in AutoCAD 2013® format using the City’s coordinate and datum and showing the locations of all new monuments/markers. The summary report shall also provide the Latitude and Longitude of all runway end markers in degrees-minutes-seconds format to three decimal places. The summary report shall be signed and sealed by a CA registered professional land surveyor.

151-2.6 Grade Around Existing Structures. The Contractor shall grade around existing utility structures that are to remain untouched, but that are in areas where the surrounding grade is being adjusted, as indicated on the Plans. The grading requirements around existing utility structures are different for flush type fire hydrants than it is for all other utility structures. The Contractor shall maintain the existing flush type fire hydrants in an accessible and useable state by fire response vehicles at all times during the Work. The location of each flush type fire hydrant shall be marked with a traffic cone or other device acceptable to the Engineer and the City of Hollister Fire Department for the duration of the Work.

151-2.7 Protect In-Place. The Contractor shall provide adequate clearance around existing facilities and take necessary measures to prevent disruption or damage to the existing facilities during the Work.

151-2.8 Disposal. All materials, upon their demolition, shall become the property of the Contractor and shall be promptly removed and properly disposed of off Airport property at a facility licenced to accept said material unless specifically noted otherwise on the Plans. No structure or utility demolition material shall be disposed of under airfield pavements. Burning of materials on the Airport property is not permitted.

METHOD OF MEASUREMENT

151-3.1 No separate measurement or payment shall be made for clearing or clearing and grubbing as shown by the limits on the plans or as ordered by the Engineer, the work covered by this specification section shall be considered as a subsidiary obligation of the contractor covered under the other contract items.

END OF ITEM P-151
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Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

   a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature.

   Unclassified excavation shall include the removal and disposal off airport property at a facility licensed to accept the material of: existing asphalt pavement, base, treated base, subbase, treated subgrades, and subgrade material that must be excavated as part of the work as shown on the Plans. All work and materials associated with this excavation and disposal will be classified and paid for under the unclassified excavation bid item of this Specification.

152-1.3 Unsuitable excavation. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod, and material designated by the Engineer as unsuitable subgrade, shall be considered unsuitable for use in the construction. Material, suitable for topsoil may be used on the embankment slope when approved by the Engineer.

   All unsuitable material excavated shall be backfilled, as required by the Engineer or as shown on the Plans, with suitable material and compacted as specified herein.

   All unsuitable excavation material shall become the property of the contractor and be properly disposed of off airport property at a properly licensed facility. The contractor shall abide by all applicable federal, state, and local laws and regulations when handling, removing, protecting in-place, and disposing of (off airport property at a properly licensed facility) all unsuitable excavated materials encountered in the work.

152-1.4 Subgrade stabilization. Subgrade stabilization methods are optional, and their usage shall be at the sole discretion of the Engineer. This item shall consist of one or a combination of the following materials:

   a. Crushed aggregate base. If crushed aggregate base material is used for stabilization, the material shall conform to the provisions in Item P-209 “Crushed Aggregate Base Course” as applicable.

   b. Geogrid reinforcement material. If geogrid reinforcement material is used for stabilization, the material shall conform to the provisions in Item P-159 “Geogrid Reinforcement Material.”

Depending on the field conditions, the Engineer reserves the option to stabilize or eliminate the stabilization of any area. The Engineer also reserves the option to select any one or a combination of the above materials and methods to stabilize any one area.
CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be completely cleared and grubbed in accordance with Item P-151, and the existing asphalt pavement removed in accordance with Item P-101.

The suitability of material to be placed in embankments shall be subject to approval by the Engineer. All unsuitable material shall be disposed of in waste areas shown on the plans. All waste areas shall be graded to allow positive drainage of the area and of adjacent areas. The surface elevation of waste areas shall not extend above the surface elevation of adjacent usable areas of the airport, unless specified on the plans or approved by the Engineer.

When the Contractor’s excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the Engineer notified per subsection 70-20. At the direction of the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Those areas outside of the limits of the pavement areas where the top layer of soil material has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches (100 mm), to loosen and pulverize the soil.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the Engineer, who shall arrange for their removal if necessary. The Contractor, at his or her expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor’s operations during the period of the contract. The Engineer shall make the determination of repair actions by the Contractor, or other “outside parties”, based on the facilities damaged. All costs of “outside parties” required to perform repairs shall be deducted from payments due the Contractor.

The Contractor shall become familiar with the character, quantity and distribution of all material to be excavated. The availability or use of information provided by Engineer is not to be construed in any way as a waiver, and the Contractor is cautioned to make such independent investigation and examination as he/she deems necessary to satisfy himself/herself as to conditions to be encountered in the performance of the work. No information derived from inspection of records of geotechnical investigation or compilation thereof made by the Engineer, or his/her assistants, shall in any way relieve the Contractor from any risk or from properly fulfilling the terms of the Contract.

The Contractor shall excavate the site in such a manner that stockpiling of excavated materials or the use of offsite borrow materials will not be necessary. If the Contractor does desire to stockpile excavated material, prior approval must be obtained from the Engineer. When approved, temporary material stockpiling may occur in the Contractor’s staging area shown on the Plans. Height restrictions for material stockpiles in the staging area shall be in accordance with Federal Aviation Regulation (FAR) Part 77 Civil Imaginary Surfaces. The Contractor shall control dust, erosion, and FOD related to the stockpiled material as required in the Plans and Specifications. No separate measurement or payment will be made for the use of material, excavated and stockpiled by the Contractor. If the Contractor desires to use offsite borrow material for backfill, prior approval must be obtained from the Engineer. No separate measurement or payment will be made for the offsite borrow material used for backfill or embankment by the Contractor.

In addition, all materials brought to the site shall be placed in the order of work in such a manner to prevent stockpiling.
152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the Engineer has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the Engineer. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes shown on the plans. All unsuitable material shall be disposed of off-site at a location appropriate for accepting said unsuitable material.

When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be disposed of off Airport property. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from off-site borrow areas.

The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the work.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the Engineer shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas so that it can be measured for payment as specified in paragraph 152-3.3.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches (300 mm) below the subgrade or to the depth specified by the Engineer. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of off the airport. This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for unclassified excavation. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans.

c. Overbreak. Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Engineer. All overbreak shall be graded or removed by the Contractor and disposed of as directed by the Engineer. The Engineer shall determine if the displacement of such material was unavoidable and his or her decision shall be final. Payment will not be made for the removal and disposal of overbreak that the Engineer determines as avoidable. Unavoidable overbreak will be classified as “Unclassified Excavation.”

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor unless otherwise shown on the plans. All existing foundations shall be excavated at least 2 feet (60 cm) below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the Engineer. All foundations thus excavated shall be backfilled with suitable material and compacted as specified.

e. Compaction requirements. For the untreated subgrade areas only, the subgrade under areas to be paved shall be scarified and re-compacted to a depth of 8-inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D1557. The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils).

The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150...
mm) of the subgrade. The finished grading operations, conforming to the typical cross-section, shall be completed and maintained at least 1,000 feet (300 m) ahead of the paving operations or as directed by the Engineer.

All loose or protruding rocks on the back slopes of cuts shall be pried loose or otherwise removed to the slope finished grade line. All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the Engineer.

Blasting shall not be allowed.

**f. Proof rolling.** After compaction is completed, the subgrade area shall be proof rolled with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds (13.6 metric tons) and inflated to a minimum of 125 psi (0.861 MPa) in the presence of the Engineer. Apply a minimum of two coverage, or as specified by the Engineer, to all paved areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch (25 mm) or show permanent deformation greater than 1 inch (25 mm) shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications.

**g. Over-Excavation.** Unsuitable material, below the finished subgrade elevation, which is deemed by the Engineer unsatisfactory for runway pavement and safety areas, subgrades, roads, and shoulders shall be excavated to the depth shown on the Plans or as specified by the Engineer. Unsuitable materials shall become the property of the Contractor and be disposed of off Airport. The over-excavated area shall be refilled through subgrade stabilization (see 152-1.4 above) as shown on the Plans or as directed by the Engineer. The “refill” material shall be thoroughly compacted by rolling to the densities as specified herein. The use of subgrade stabilization material for refilling over-excavations will be considered part of the various bid items that constitute the selected method of stabilization and will be measured and paid as defined in those items.

**152-2.3 Borrow excavation.** Borrow areas within the airport property are not available.

For borrow sources that are outside the boundaries of the airport property, it shall be the Contractor’s responsibility to locate and obtain the borrow sources, subject to the approval of the Engineer. The Contractor shall notify the Engineer at least 15 days prior to beginning the excavation so necessary measurements and tests can be made. All borrow pits shall be opened up to expose the various strata of acceptable material to allow obtaining a uniform product. All unsuitable material shall be disposed of by the Contractor. Borrow pits shall be excavated to regular lines to permit accurate measurements, and they shall be drained and left in a neat, presentable condition with all slopes dressed uniformly. Imported borrow material to be used in fills shall have a plasticity index of 15 or less, and a liquid limit of 35 or less.

**152-2.4 Drainage excavation.** Not Used.

**152-2.5 Preparation of embankment area.** Where an embankment is to be constructed to a height of 4 feet (1.2 m) or less, all sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches (150 mm) and shall then be compacted as indicated in paragraph 152-2.6. When the height of fill is greater than 4 feet (1.2 m), sod not required to be removed shall be thoroughly disked and recompacted to the density of the surrounding ground before construction of embankment. Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches (300 mm) and compacted as specified for the adjacent fill.
No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

**152-2.6 Formation of embankments.** Embankments shall be formed in successive horizontal layers of not more than 8 inches (200 mm) in loose depth for the full width of the cross-section, unless otherwise approved by the Engineer.

The layers shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the Engineer. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each layer shall be within \( \pm 2\% \) of optimum moisture content before rolling to obtain the prescribed compaction. To achieve a uniform moisture content throughout the layer, the material shall be moistened or aerated as necessary. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken for each **1,000 square yards (840 square meters)** of material placed per layer. Based on these tests, the Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content to achieve the specified embankment density.

If nuclear density machines are to be used for density determination, the machines shall be calibrated in accordance with ASTM D6938.

Rolling operations shall be continued until the embankment is compacted to not less than 95% of maximum density for noncohesive soils, and 90% of maximum density for cohesive soils as determined by ASTM **D1557**. Under all areas to be paved, the embankments shall be compacted to a depth of **18-inches** and to a density of not less than **95** percent of the maximum density as determined by ASTM **D1557**.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches (100 mm). The in-place field density shall be determined in accordance with ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Contractor’s laboratory shall perform all density tests in the Engineer’s presence and provide the test results upon completion to the Engineer for acceptance.

Compaction areas shall be kept separate, and no layer shall be covered by another layer until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each layer is placed. Layer placement shall begin in the deepest portion of the embankment fill. As placement progresses, the layers shall be constructed approximately parallel to the finished pavement grade line.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future paved areas. Stones or fragmentary rock larger than 4 inches (100 mm) in their greatest dimensions will not be allowed in the top 6 inches (150 mm) of the subgrade. Rockfill shall be brought up in layers as specified or as directed by the Engineer and the finer material shall be used to fill the voids with forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankment areas, except at places and in the manner designated on the plans or by the Engineer.
When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in layers not exceeding 2 feet (60 cm) in thickness. Each layer shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The layer shall not be constructed above an elevation 4 feet (1.2 m) below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in layers, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for excavation, borrow, or other items.

152-2.7 Finishing and protection of subgrade. After the subgrade is substantially complete, the Contractor shall remove any soft or other unstable material over the full width of the subgrade that will not compact properly. All low areas, holes or depressions in the subgrade shall be brought to grade with suitable select material. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans.

Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes. All ruts or rough places that develop in the completed subgrade shall be graded and recompacted.

No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been approved by the Engineer.

152-2.8 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

152-2.9 Tolerances. In those areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 12-foot (3.7-m) straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2 inch (12 mm), or shall not be more than 0.05 feet (15 mm) from true grade as established by grade hubs. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials; reshaping; and recompacting.

On safety areas, intermediate and other designated areas, the surface shall be of such smoothness that it will not vary more than 0.10 feet (3 cm) from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

The Contractor shall be responsible for the staking of all grade hubs.

152-2.10 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall not be placed within 200 feet of runway pavement or 100 feet of taxiway pavement and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the Engineer, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further rehandling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as directed, or as required in Item T-905.
No direct payment will be made for topsoil under Item P-152. The quantity removed and placed directly or stockpiled shall be paid for at the contract unit price per cubic yard (cubic meter) for “Unclassified Excavation.”

When stockpiling of topsoil and later rehandling of such material is directed by the Engineer, the material so rehandled shall be paid for at the contract unit price per cubic yard (cubic meter) for “topsoiling,” as provided in Item T-905.

152-2.11 Deep Ripping. If required by the Engineer, the Contractor shall perform deep ripping of the existing subgrade in the areas to receive lime-treatment. The depth of ripping shall be sufficient to extend to, but not penetrate below, the bottom of lime-treated subgrade layer as shown on the Plans. The objective of the deep ripping is to promote a more workable subgrade moisture content for subsequent construction processes. The Contractor shall perform multiple passes of deep ripping as required, with sufficient drying time between passes.

Deep ripping of subgrade material is optional, and its usage shall be at the sole discretion of the Engineer.

152-2.12 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 necessary be limited to tests for material density, material moisture content, rolling patterns, and embankment lift thickness.

   a. Material Density. The in-place field density shall be determined in accordance with ASTM D 1556. Nuclear moisture and density methods meeting ASTM ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 may be used provided: 1) The equipment is calibrated in accordance with ASTM D6938; and 2) that at least one (1) out of ten (10) tests are conducted using the ASTM D 1556 method to correlate test results.

   b. Material Moisture Content. The material in each layer shall be within plus or minus two (2) percent of optimum moisture content before rolling to obtain the prescribed compaction.

   c. Rolling Patterns. Where soils are too coarse to be tested by conventional procedures, they shall be compacted using a minimum roller specification. Each lift shall be subjected to ten (10) coverages with a vibratory roller having a static weight of at least 25,000 pounds. The weight of the vibratory portion (including drum, shaft and internal machinery) should be at least 12,000 pounds. The frequency of the vibration during operation should be between 1,100 and 1,500 cycles per minute and the dynamic force at the operating frequency should not be less than 40,000 pounds. The maximum roller speed during operations should be no greater than 1.5 miles-per-hour. The soil should be thoroughly wetted during the compaction process. The compaction equipment shall be subject to the approval of the Engineer.

   d. Grade. All areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness, that when tested with a 12-feet straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of ½-inch, or shall not be more than 0.05-feet from true grade. Any deviation in excess of these amounts shall be corrected by the Contractor by loosening, adding, or removing materials, reshaping and re-compacting as necessary.

   e. Fugitive Dust. The Contractor shall supply and operate all necessary equipment and personnel to meet the requirements for dust control. The Contractor shall document dust control procedures in the daily Quality Control reports.
152.2.13 **Engineer’s Quality Assurance (QA) Testing.** The Engineer and/or the Engineer’s representatives will at the Engineer’s discretion, verify the quality of the construction by means of QA testing. Costs for QA testing will be borne by the Airport except when re-testing of failed material is required. All QA re-tests shall be at the sole cost of the Contractor. The Contractor shall perform the work in a manner to afford the Engineer’s representative sufficient notice and time to complete and report the results of the QA tests. All excavations and finished subgrade formation shall be subject to QA testing and surveillance by the Engineer and/or the Engineer’s representatives. No areas of work shall be covered until the Engineer has deemed the results of the QA tests to be in compliance with the contract documents. Prior to start of construction, the Engineer and Contractor’s Quality Control (QC) laboratory shall have a conference meeting to discuss the proposed QA/QC testing, roles of each party and co-ordinate the QC testing program to be implemented in the field. Surveillance by the Engineer does not relieve the Contractor of performing quality control testing and inspections of either on-site or off-site Contractor's or subcontractor's work.

**METHOD OF MEASUREMENT**

152.3.1 The quantity of excavation to be paid for shall be the number of cubic yards (cubic meters) measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

152.3.2 Borrow material shall not be paid for separately; if performed, it shall be considered a subsidiary obligation of the Contractor covered under the other contract items.

152.3.3 Stockpiled material shall not be paid for separately; if performed it shall be considered a subsidiary obligation of the Contractor covered under the other contract items.

152.3.4 For payment specified by the cubic yard (cubic meter), measurement for all excavation shall be computed by the Engineer. Unclassified excavation quantities will be measured from the original ground line established by the existing contours shown on the Plans to the prescribed finished subgrade neat lines established by the grading contours as shown on the Plans, subject to verification by the Engineer. After completion of all excavation operations and prior to the placing of base or subbase material, the final excavation shall be verified by the Contractor by means of field cross-sections taken randomly at intervals not exceeding 50 linear feet (15 m) and across the full width of the runway excavation. Said cross-sections shall be performed by a licensed surveyor registered in the state of California. The finished cross-section survey shall be provided to the Engineer in signed and sealed hard copy and electronic AutoCAD® 2013 format.

152.3.5 Unsuitable excavation shall be measured for on the basis of the number of cubic yards of unsuitable material excavated in its original position and properly disposed of off Airport property as required by all applicable Federal, State and local laws and regulations and as specified herein or directed by the Engineer. Over-excavation shall be paid for under unclassified excavation.

152.3.5 Deep ripping shall be measured for on the basis of the number of calendar days (based on 24 hour day) where deep ripping is carried out for at least 6 hours out of the 24 hours toward completion of the contract. This price shall include mobilization and demobilizing, furnishings, maintaining, and operating deep ripping equipment. Ripping operations that do not meet the minimum 6 hours of operation within a 24 hour day shall be considered incidental to the project and no payment shall be made therefor.
BASIS OF PAYMENT

152-4.1 “Unclassified excavation” payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.2 “Rock Excavation” – Not Used.

152-4.3 “Muck Excavation” – Not Used.

152-4.4 “Drainage Excavation” – Not Used.

152-4.5 “Borrow Excavation” – Not Used.

152-4.6 “Stockpiled Material” – Not Used.

152-4.7 “Embankment in place” – Not Used.

152-4.8 “Unsuitable excavation” payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.9 “Deep ripping” payment shall be made at the contract unit price per calendar day. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

- Item P-152-4.1 Unclassified Excavation - per cubic yard (cubic meter)
- Item P-152-4.2 Rock Excavation – Not Used
- Item P-152-4.3 Muck Excavation – Not Used
- Item P-152-4.4 Drainage Excavation - Not Used
- Item P-152-4.5 Borrow Excavation - Not Used
- Item P-152-4.6 Stockpiled material - Not Used
- Item P-152-4.7 Embankment in place - Not Used
- Item P-152-4.8 Unsuitable Excavation - per cubic yard (cubic meter)
- Item P-152-4.9 Deep Ripping - per calendar day

TESTING REQUIREMENTS

- ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
- ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
- ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN-m/m³))
- ASTM D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-152
Item P-153 Controlled Low-Strength Material (CLSM)

DESCRIPTION

153-1.1 This item shall consist of furnishing, transporting, and placing a controlled low-strength material (CLSM) as flowable backfill in trenches or at other locations shown on the plans or as directed by the Engineer.

MATERIALS

153-2.1 Materials.

   a. Portland cement. Portland cement shall conform to the requirements of ASTM C150 Type II. 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.

   b. Fly ash. Fly ash shall conform to ASTM C618, Class C or F.

   c. Fine aggregate (sand). Fine aggregate shall conform to the requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces performance characteristics of the CLSM specified here will be accepted, except as follows.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch (19 mm)</td>
<td>100</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>0 - 12</td>
</tr>
</tbody>
</table>

   d. Water. Water used in mixing shall be potable and free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product.

MIX DESIGN

153-3.1 Proportions. The Contractor shall submit, to the Engineer, a mix design including the proportions and source of aggregate, fly ash, cement, water, and approved admixtures. No CLSM mixture shall be produced for payment until the Engineer has given written approval of the proportions. The proportions shall be prepared by a laboratory and shall remain in effect for the duration of the project. Laboratory costs are incidental to this item. The proportions shall establish a single percentage or weight for aggregate, fly ash, cement, water, and any admixtures proposed.

   a. Compressive strength. CLSM shall be designed to achieve a 28-day compressive strength of 100 to 200 psi (690 to 1379 kPa) when tested in accordance with ASTM D4832. There should be no significant strength gain after 28 days.

   b. Consistency. CLSM should be designed to achieve a consistency that will produce an approximate 8-inch (200 mm) diameter circular-type spread without segregation when tested by: (1) filling a 3-inch inside diameter by 6-inch length flow cylinder (non-absorbent pipe) (2) strike off of the flow cylinder and start of lift within five seconds of filling and (3) by steady upward pull, lift the cylinder in a time period of between two and four seconds. Adjustments of the material proportions should be made to
achieve proper solid suspension and flowable characteristics, however the theoretical yield shall be maintained at one cubic yard (cubic meter) for the given batch weights.

CONSTRUCTION METHODS

153-4.1 Placement.

   a. Placement. CLSM may be placed by any reasonable means from a mixing unit into the space to be filled. Agitation is required during transportation and waiting time. Placement shall be performed so structures or pipes are not displaced from their final position and intrusion of CLSM into unwanted areas is avoided. The material shall be brought up uniformly to the fill line shown on the plans or as directed by the Engineer. Each placement of CLSM shall be as continuous an operation as possible. If CLSM is placed in more than one layer, the base layer shall be free of surface water and loose foreign material prior to placement of the next layer.

   b. Limitations of placement. CLSM shall not be placed on frozen ground. Mixing and placing may begin when the air or ground temperature is at least 35°F (2°C) and rising. At the time of placement, CLSM shall have a temperature of at least 40°F (4°C). Mixing and placement shall stop when the air temperature is 40°F (4°C) and falling or when the anticipated air or ground temperature will be 35°F (2°C) or less in the 24 hour period following proposed placement.

153-4.2 Curing and protection

   a. Curing. The air in contact with the CLSM shall be maintained at temperatures above freezing for a minimum of 72 hours. If the CLSM is subjected to temperatures below 32°F (0°C), the material may be rejected by the Engineer if damage to the material is observed.

   b. Protection. The CLSM shall not be subject to loads and shall remain undisturbed by construction activities for a period of 48 hours or until a compressive strength of 15 psi (105 kPa) is obtained. The Contractor shall be responsible for providing evidence to the Engineer that the material has reached the desired strength. Acceptable evidence shall be based upon compressive tests made in accordance with paragraph 153-3.1a.

153-4.3 Acceptance. Acceptance of CLSM delivered and placed as shown on the plans or as directed by the Engineer shall be based upon mix design approval and batch tickets provided by the Contractor to confirm that the delivered material conforms to the mix design. The Contractor shall verify by additional quality control testing, each 1,000 cubic yards (765 m³) of material used. Verification shall include confirmation of material proportions and tests of compressive strength to confirm that the material meets the original mix design and the requirements of CLSM as defined in this specification. Adjustments shall be made as necessary to the proportions and materials prior to further production.

153-4.4 Quality Control. The Contractor shall incorporate the quality control testing required under this specification item into the Contractor’s Quality Control Program.

METHOD OF MEASUREMENT

153-5.1 Measurement. Controlled low-strength material shall not be measured or paid for separately, it shall be considered a subsidiary obligation of the Contractor covered under the other contract items.
TESTING REQUIREMENTS

ASTM D4832 Standard Test Method for Preparation and Testing of Controlled Low-Strength Material (CLSM) Test Cylinders

MATERIAL REQUIREMENTS

ASTM C33 Standard Specification for Concrete Aggregates
ASTM C150 Standard Specification for Portland Cement
ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C595 Standard Specification for Blended Hydraulic Cements

END OF ITEM P-153
Item P-154 Subbase Course

DESCRIPTION

154-1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross-section shown on the plans.

MATERIALS

154-2.1 Materials. The subbase material shall consist of hard durable particles or fragments of granular aggregates. This material will be mixed or blended with fine sand, clay, stone dust, or other similar binding or filler materials produced from approved sources. This mixture must be uniform and shall comply with the requirements of these specifications as to gradation, soil constants, and shall be capable of being compacted into a dense and stable subbase. The material shall be free from organic material including reclaimed asphalt pavement, vegetative matter, lumps or excessive amounts of clay, and other objectionable or foreign substances. Pit-run material may be used, provided the material meets the gradation requirements specified.

<table>
<thead>
<tr>
<th>Sieve designation (square openings) as per ASTM C136 and ASTM D422</th>
<th>Percentage by weight passing sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 inch (75 mm)</td>
<td>100</td>
</tr>
<tr>
<td>No. 10 (2.0 mm)</td>
<td>20-100</td>
</tr>
<tr>
<td>No. 40 (0.450 mm)</td>
<td>5-60</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>0-8</td>
</tr>
</tbody>
</table>

The portion of the material passing the No. 40 (0.450 mm) sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than six (6) when tested in accordance with ASTM D4318.

154-2.2 Sampling and testing. Material used on the project shall be sampled per ASTM D75 and tested by the Contractor’s quality control laboratory per ASTM C136 and ASTM C117. Results shall be furnished to the Engineer by the Contractor prior to the start of construction and at least two (2) samples per lot during construction. The lot shall be consistent with the lot size used for density. All results during construction shall be made available to the Engineer within 24-hours of sampling.

CONSTRUCTION METHODS

154-3.1 General. The subbase course shall be placed where designated on the plans or as directed by the Engineer. The material shall be shaped and thoroughly compacted within the tolerances specified.

Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support the construction equipment without movement, shall be mechanically stabilized to the depth necessary to provide stability as directed by the Engineer. The mechanical stabilization shall include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing.
strength, so the course will not deform under construction equipment traffic. The addition of the binding medium to the subbase material shall not increase the soil constants of that material above the specified limits.

154-3.2 Operation in pits. The subbase material shall be obtained from pits or sources that have been approved by the Engineer. The material in the pits shall be excavated and handled to produce a uniform and satisfactory product. All work involved in clearing and stripping pits and handling unsuitable material encountered shall be performed by the Contractor. The cost of this work is incidental to this item.

154-3.3 Preparing underlying course. Prior to constructing the subbase course, clean the underlying course or subgrade of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Correct ruts, or soft yielding spots, in the underlying courses and subgrade areas having inadequate compaction and deviations of the surface from the specified requirements by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the overlying course. Accomplish stabilization by mixing the overlying course material into the underlying course, and compacting by approved methods. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the overlying course is placed. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.

To protect the subgrade and to ensure proper drainage, the spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

154-3.4 Materials acceptance in existing condition. When the entire subbase material is in a uniform and satisfactory condition at approximately the required moisture content, the approved material may be moved directly to the spreading equipment for placing. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The intent of the specifications is to secure materials that will not require further mixing. The moisture content of the material shall be approximately that required to obtain maximum density. Any minor deficiency or excess in moisture content may be corrected by surface sprinkling or by aeration. Some mixing or aeration may be required prior to rolling to obtain the required moisture content. Blading or dragging, if necessary, shall be performed to obtain a smooth uniform surface true to line and grade.

154-3.5 Plant mixing. When materials from several sources will be blended and mixed, the subbase material shall be processed in a central mixing plant. The subbase material, together with any blended material, shall be thoroughly mixed with the required amount of water. After the mixing is complete, the material shall be transported to and spread on the underlying course without undue loss of moisture content.

154-3.6 General methods for placing. The subbase course shall be constructed in layers of not less than inches (75 mm) nor more than 8 inches (200 mm) of compacted thickness. The subbase material shall be deposited and spread evenly to a uniform thickness and width. The material, as spread, shall be of uniform gradation with no pockets of fine or coarse materials. The subbase, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards (1700 sq m) in advance of the rolling. Any necessary sprinkling shall be kept within this limit. 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 here shall apply similarly to each layer.

During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, shoulder, or foreign material in the subbase course mixture.
154-3.7 Finishing and compacting. After spreading or mixing, the subbase material shall be thoroughly compacted by rolling and sprinkling, when necessary. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the subbase course.

The field density of the compacted material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The in-place field density shall be determined in accordance with ASTM D1556. Test in accordance with ASTM D4718 if greater than 30% is retained on the 3/4” sieve. ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The moisture content of the material at the start of compaction shall be within ±2% of the optimum moisture content. All testing shall be done by the Contractor’s laboratory in the presence of the Engineer, and density test results shall be furnished upon completion to the Engineer for acceptance determination.

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the subbase. When the rolling develops irregularities that exceed 3/8 inch (9 mm) when tested with a 12 feet (3.7 m) straightedge, the irregular surface shall be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required above.

Along places inaccessible to rollers, the subbase material shall be tamped thoroughly with mechanical or hand tampers.

Sprinkling during rolling, if necessary, shall be by equipment approved by the Engineer. Water shall not be added in manner or quantity that allows free water to reach the underlying layer and cause it to become soft.

154-3.8 Surface tolerance. The surface of the top layer shall show no deviations in excess of 3/8 inch (9 mm) when tested with a 12-foot (3.7-m) straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot (15 meter) intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

154-3.9 Thickness control. The completed thickness of the course(s) shall be in accordance with the thickness and grade indicated on the drawings. The completed course shall not be more than 1/2 inch (12 mm) deficient in thickness nor more than 1/2 inch (12 mm) above or below the established grade. Where any of these tolerances are exceeded, correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 1/2 inch (12 mm) or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 1/2 inch (12 mm). The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch (6 mm) of the thickness shown. The thickness of the completed subbase course shall be determined by depth tests or sample holes taken at intervals so each test shall represent no more than 500 square yards (420 sq m) by survey.

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When subbase or rigid pavement base courses are constructed less than 6 inches (150 mm) in total thickness, a deficiency of 1/2 inch (12 mm) in the thickness of any area of such paving is considered excessive. Applicable to job conditions, the thickness tolerance provisions will be modified as required, restricting all deficiencies to less than 1/4 inch (6 mm).
**154-3.10 Protection.** Work on subbase course shall not be conducted during freezing temperatures nor when the subgrade is wet. When the subbase material contains frozen material or when the underlying course is frozen, the construction shall be stopped. The Contractor shall protect and maintain the subgrade from yielding until the subbase is accepted.

**154-3.11 Maintenance.** The Contractor shall maintain the completed course in a satisfactory condition until accepted by the Engineer.

**METHOD OF MEASUREMENT**

**154-4.1** Subbase course shall be measured by the number of cubic yards (cubic meters) of subbase course material placed, compacted, and accepted in the completed course. The quantity of subbase course material shall be measured in final position based upon depth tests or cores taken as directed by the Engineer, at the rate of one (1) depth test for each 500 square yard (420 sq m) of subbase course. On individual depth measurements, thicknesses more than 1/2 inch (12 mm) in excess of that shown on the plans shall be considered as the specified thickness plus 1/2 inch (12 mm) in computing the yardage for payment. Subbase materials shall not be included in any other excavation quantities.

**BASIS OF PAYMENT**

**154-5.1** Payment shall be made at the contract unit price per cubic yard (cubic meter) for subbase course. This price shall be full compensation for furnishing all materials; for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item. Payment will be made under:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item P-154-5.1</td>
<td>Subbase Course - per cubic yard (cubic meter)</td>
</tr>
</tbody>
</table>

**TESTING REQUIREMENTS**

- ASTM D75: Standard Practice for Sampling Aggregates
- ASTM D422: Standard Test Method for Particle-Size Analysis of Soils
- ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
- ASTM D1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
- ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
- ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
<table>
<thead>
<tr>
<th>ASTM D4253</th>
<th>Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D4718</td>
<td>Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles</td>
</tr>
<tr>
<td>ASTM D6938</td>
<td>Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)</td>
</tr>
</tbody>
</table>

**END OF ITEM P-154**
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Item P-155 Lime-Treated Subgrade

DESCRIPTION

155-1.1 This item shall be used for soil modification to achieve specific needs that require strength gain to a specific level. This item shall consist of constructing one or more courses of a mixture of soil, lime, and water in accordance with this specification, and in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans.

MATERIALS

155-2.1 Lime. Quicklime and hydrated lime, either high-calcium dolomitic, or magnesium lime, as defined by ASTM C51, shall conform to the requirements of ASTM C977. Lime not produced from calcining limestone shall not be permitted.

155-2.2 Commercial lime slurry. Commercial lime slurry shall be a pumpable suspension of solids in water. The water or liquid portion of the slurry shall not contain dissolved material in sufficient quantity naturally injurious or objectionable for the purpose intended. The solids portion of the mixture, when considered on the basis of “solids content,” shall consist principally of hydrated lime of a quality and fineness sufficient to meet the following requirements as to chemical composition and residue.

   a. Chemical composition. The “solids content” of the lime slurry shall consist of a minimum of 70%, by weight, of calcium and magnesium oxides.

   b. Residue. The percent by weight of residue retained in the “solids content” of lime slurry shall conform to the following requirements:
      
      Residue retained on a No. 6 (3360 micron) sieve = maximum 0.0%
      Residue retained on a No. 10 (2000 micron) sieve = maximum 1.0%
      Residue retained on a No. 30 (590 micron) sieve = maximum 2.5%

   c. Grade. Commercial lime slurry shall conform to one of the following two grades:
      
      Grade 1. The “dry solids content” shall be at least 31% by weight, of the slurry.
      Grade 2. The “dry solids content” shall be at least 35%, by weight, of the slurry.

155-2.3 Water. Water used for mixing or curing shall be potable, reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product.

155-2.4 Soil. The soil for this work shall consist of inorganic natural materials on the site or selected materials from other sources; uniform in quality and gradation; and shall be approved by the Engineer. The soil shall be free of roots, sod, weeds, and stones larger than 2-1/2 inches (60 mm).

COMPOSITION

155-3.1 Soil-lime mixture. It is the Contractor’s responsibility to complete mix design verification testing on the existing subgrade soils for submittal to the Engineer for review. The verification testing shall include; moisture contents in accordance with ASTM D2216; plasticity index in accordance with ASTM D4318; lime stability in accordance with ASTM D6276; modify proctor compaction in
accordance with ASTM D1557; and California Bearing Ratio (CBR) in accordance with ASTM D1883 performed on each point of the compaction test performed in accordance with Method C of ASTM D1557. The Contractor shall obtain samples for verification testing from material which will represent the final placement of material to be lime-treated.

The values in Table 1 below shall be used as the minimum lime application rates for the depth of subgrade treatment shown on the Plans:

<table>
<thead>
<tr>
<th>Material</th>
<th>Application Rate(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolemetric Quicklime</td>
<td>7% by dry weight</td>
</tr>
<tr>
<td>High Calcium Quicklime</td>
<td>6% by dry weight</td>
</tr>
</tbody>
</table>

\(^1\) For the purposes of evaluating the weight of the lime to be employed, a soil dry unit weight of 130 pounds per cubic foot shall be used.

155-3.2 Tolerances. At final compaction, the lime and water content for each course of subgrade treatment shall conform to the following tolerances:

<table>
<thead>
<tr>
<th>Material</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lime</td>
<td>+ 0.5%</td>
</tr>
<tr>
<td>Water</td>
<td>+ 2%, -0%</td>
</tr>
</tbody>
</table>

WEATHER LIMITATIONS

155-4.1 Weather limitation. Do not construct subgrade when weather conditions detrimentally affect the quality of the materials. Do not apply lime unless the air temperature is at least 40°F (4°C) and rising. Do not apply lime to soils that are frozen or contain frost. If the air temperature falls below 35°F (2°C), protect completed lime-treated areas by approved methods against the detrimental effects of freezing. Remove and replace any damaged portion of the completed soil-lime treated area with new soil-lime material in accordance with this specification.

EQUIPMENT

155-5.1 Equipment. The equipment required shall include all equipment necessary to complete this item such as: grading and scarifying equipment, a spreader for the lime or lime slurry, mixing or pulverizing equipment, sheepsfoot and pneumatic or vibrating rollers, sprinkling equipment, and trucks.

CONSTRUCTION METHODS

155-6.1 General. This specification is to construct a subgrade consisting of a uniform lime mixture which shall be free from loose or segregated areas. The subgrade shall be of uniform density and moisture content, well mixed for its full depth, and have a smooth surface suitable for placing subsequent courses. The Contractor shall be responsible to meet the above requirements.

Before beginning lime treatment, the subgrade shall be constructed as specified in Item P-152, Excavation, Subgrade and Embankment, and shaped to conform to the typical sections, lines, and grades.
as shown on the plans. If the Contractor elects to use a cutting and pulverizing machine that will remove
the subgrade material accurately to the secondary grade and pulverize the material at the same time, he
will not be required to expose the secondary grade nor windrow the material. The machine must give
visible indication at all times that it is cutting the material uniformly to the proper depth over the entire
width of the cut.

If a cutting and pulverizing machine is not used, the material to be treated shall be excavated to the
secondary grade (proposed bottom of lime treatment) and removed or windrowed to expose the secondary
grade. The excavated material shall then be spread to the desired cross-section and uniformly mixed and
compacted.

155-6.2 Application. Lime shall be spread only over an area where the initial mixing operations can be
completed during the same work day. The application and mixing of lime with the soil shall be
accomplished by the methods described as “Dry Placing” or “Slurry Placing.” The Contractor may use
either method when hydrated lime is specified.

   a. Dry placing. The lime shall be spread uniformly over the subgrade by an approved screw-type
      spreader box or other approved spreading equipment. The amount of lime spread shall be the amount
      required for mixing to the specified depth that will result in the amount determined in the soil-lime
      mixture. The material shall be sprinkled until the specified moisture content has been reached.

      The lime shall be distributed in a manner that will minimize scattering by wind. Lime shall not be
      applied when wind conditions, in the opinion of the Engineer, are detrimental to proper application. A
      motor grader shall not be used to spread the lime.

   b. Slurry placing. The lime shall be mixed with water in trucks with approved distributors and
      applied as a thin water suspension or slurry. Commercial lime slurry shall be applied with a lime
      percentage not less than that applicable for the grade used. The distribution of lime shall be by successive
      passes over a measured section of subgrade until the specified amount of lime has been spread. The
      amount of lime spread shall be the amount required for mixing to the specified depth that will result in the amount
determined in the soil-lime mixture. The distributor truck shall continually agitate the slurry to
      keep the mixture uniform.

155-6.3 Mixing. The mixing procedure shall be the same for “Dry Placing” or “Slurry Placing” as
described below:

   a. Preliminary mixing. The full depth of the treated subgrade shall be mixed with an approved
      mixing machine. Lime shall not be left exposed for more than six (6) hours. The mixing machine shall
      make two coverages. Water shall be added to the subgrade during mixing to provide a moisture content
      approximately 5% above the optimum moisture of the material and to ensure chemical action of the lime
      and subgrade. After mixing, the subgrade shall be lightly rolled with smooth steel wheel rollers to seal the
      surface and help prevent evaporation of moisture. The water content of the subgrade mixture shall be
      maintained at a moisture content above the optimum moisture content for a minimum of 48 hours or until
      the material becomes friable. During the curing period, the material shall be sprinkled as directed by the
      Engineer.

   b. Final mixing. After the required curing time, the material shall be uniformly mixed by approved
      methods. The mixing machine shall make at least three coverages for final mixing. If the mixture contains
      clods, they shall be reduced in size by blading, discing, harrowing, scarifying, or the use of other
      approved pulverization methods so that the remainder of the clods shall meet the following requirements
      when tested dry by laboratory sieves. After curing, pulverize lime treated material until soil particles pass
      a one inch (25 mm) sieve and 60% pass the No. 4 (4.75 mm) sieve. If resultant mixture contains clods,
      reduce their size by scarifying, remixing, or pulverization to meet specified gradation.
**155-6.4 Compaction.** Compaction of the mixture shall immediately follow the final mixing operation with no part of the mixture uncompacted more than 30 minutes after final mixing. The material shall be aerated or sprinkled as necessary to provide the optimum moisture content during compaction. The field density of the compacted mixture shall be at least 95% of the maximum density of laboratory specimens prepared from samples taken from the material in place. The specimens shall be compacted and tested in accordance with ASTM D1557 to determine maximum density and optimum moisture content. The in-place field density shall be determined in accordance with ASTM D6938, Procedure A, direct transmission method except that every fifth test and at least two per day, shall be performed in accordance with ASTM D1556. Testing frequency performed by the Contractor’s quality control laboratory, shall be a minimum of one compaction test per 500 square yards (420 square meters) of stabilized subgrade or as directed by the Engineer.

The material shall be sprinkled and rolled as directed by the Engineer. All irregularities, depressions, or weak spots that develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required, and reshaping and recompacting. The surface of the subgrade shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed on it or the work is accepted by the Engineer.

The full depth of the material shown on the plans shall be compacted to remain firm and stable under construction equipment. All testing shall be done by the Contractor’s laboratory in the presence of the Engineer and density test results shall be furnished daily to the Engineer for acceptance determination. The Contractor shall perform in-place density test to determine degree of compaction between 24 and 72 hours after final compaction and 24 hour moist cure period. If the material fails to meet the density requirements, it shall be reworked to meet the density requirements. The shape of the course shall be maintained smooth and shall conform to the typical section shown on the plans and the established lines and grades. If the material loses the specified stability, density, and finish before the next course is placed or the work is accepted by the Engineer, the material shall be recompacted and refinished by the Contractor, and the cost shall be incidental to this item.

**155-6.5 Finishing and curing.** After the final layer or course of lime-treated subgrade has been compacted and within two days of final compaction, it shall be brought to the required lines and grades in accordance with the typical sections. The Contractor shall trim the compacted material to conform to the typical section and the established lines and grades. Excess material resulting from trimming shall become the property of the Contractor and shall be disposed of off Airport property. No additional compensation shall be made for the trimming and disposal of any excess material, it shall be considered incidental to this item. The completed section shall then be finished by rolling, as directed by the Engineer, with a pneumatic or other suitable roller sufficiently light to prevent hairline cracking. The finished surface shall not vary more than 3/8 inch (9 mm) when tested with a 12 feet (3.7 m) straightedge applied parallel with and at right angles to the pavement centerline. Any variations in excess of this tolerance shall be corrected by the Contractor in a manner satisfactory to the Engineer, and the cost shall be incidental to this item. The Contractor shall provide the Engineer with a 12 foot straightedge for quality assurance testing of the finished grade.

The completed section shall be moist-cured for a minimum of seven (7) days before further courses are added or any traffic is permitted, unless otherwise directed by the Engineer. The Contractor shall not permit any construction equipment or traffic to travel on the lime-treated subgrade until the seven (7) day cure period has elapsed. Subsequent courses shall be applied within 14 days after the lime-treated subgrade is cured.

**155-6.6 Thickness control.** The thickness of the final lime-treated subgrade shall be not less than the thickness specified. Thickness shall be determined by depth tests or cores taken at intervals so that each test shall represent no more than 300 square yards (250 sq m). When the base deficiency is more than 1/2 inch (12 mm), the Contractor shall correct such areas in a manner satisfactory to the Engineer. The
Contractor shall replace the base material where borings are taken for test purposes. This cost shall be incidental to this item.

155-6.7 Maintenance. The Contractor shall protect and maintain the lime-treated subgrade from yielding until the lime-treated subgrade is covered by placement of the next layer. The cost of this maintenance shall be incidental to this item.

155-6.8 Handling and safety. The Contractor shall obtain and enforce the lime supplier’s instructions for proper safety and handling of the lime to prevent physical eye or skin contact with lime during transport or application.

155-6.9 Quality Control Testing. The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to this specification item. The Quality Control Program shall include, but not necessary be limited to tests for material density, material moisture content, rolling patterns, finished grade, and treated subgrade thickness.

METHOD OF MEASUREMENT

155-7.1 Lime-treated subgrade shall be paid for by the square yard (square meter) in the completed and accepted work.

155-7.2 Lime shall not be measured or paid for separately, it shall be deemed included in the contract price paid for lime-treated subgrade.

BASIS OF PAYMENT

155-8.1 Payment shall be made at the contract unit price per square yard (square meter) for the lime-treated subgrade at the thickness specified on the Plans. The price shall be full compensation for furnishing all material, including the lime, and for all preparation, delivering, placing and mixing these materials, and all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Item P-155-8.1 Lime-treated subgrade - per square yard (m²)

TESTING REQUIREMENTS

ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)

ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

MATERIAL REQUIREMENTS

ASTM C51 Standard Terminology Relating to Lime and Limestone (as used by the Industry)
ASTM C977  Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization
ASTM D3551 Standard Practice for Laboratory Preparation of Soil-Lime Mixtures Using Mechanical Mixer

END OF ITEM P-155
Item P-156 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

156-1.1 This item shall consist of temporary control measures as shown on the plans, as required for the SWPPP, or as ordered by the Engineer during the life of a contract to control water pollution, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be design, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

The Contractor shall develop and submit for review and approval to the Engineer a Storm Water Pollution Control Plan (SWPPP). The Contractor shall be responsible for providing a Qualified SWPPP Developer (QSD). The QSD shall be responsible for developing the SWPPP in accordance with General Permit, and for submittal to the Regional Board and for obtaining the Waste Discharger Identification (WDID) number. The Contractor shall use the California Storm Water Quality Association Construction BMP Handbook / Portal, in the preparation of the SWPPP. The handbooks may be downloaded from the California Storm water BMP Handbook web site at: http://www.cabmphandbooks.com/.

The temporary erosion control measures shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control shall include work outside the construction limits such as borrow pit operations, equipment and material storage sites, haul routes, waste areas, and temporary plant sites.

The objectives of the SWPPP shall be to identify pollution sources that may adversely affect the quality of storm water discharges associated with the project and to identify, construct, implement, and maintain water pollution control measures, hereafter referred to as control measures, to reduce to the extent feasible pollutants in storm water discharges from the construction site during construction under this Contract.

The SWPPP shall incorporate control measures in the following categories:

1. Soil stabilization practices;
2. Sediment control practices;
3. Sediment tracking control practices;
4. Wind erosion control practices; and
5. Non-storm water management and waste management and disposal control practices.

Specific objectives and minimum requirements for each category of control measures shall be contained in the SWPPP.
MATERIALS

156-2.1 Grass. Grass that will not compete with the grasses sown later for permanent cover per Item T-901 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

156-2.2 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

156-2.3 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all Federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

156-2.4 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, Portland cement concrete, bituminous concrete, or other materials that will adequately control erosion.

156-2.5 Silt fence. The silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

156-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the Engineer before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

156-3.1 General. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply. The Engineer shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

To ensure the proper implementation and functioning of control measures, the Contractor shall regularly inspect and maintain the construction site for the control measures identified in the SWPPP. The Contractor shall identify corrective actions and time frames to address any deficient measures or reinitiate any measures that have been discontinued.

If the Contractor or the Engineer, identify a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected by the Contractor immediately, or by a later date and time if requested by the Contractor and approved by the Engineer in writing, but not later than the onset of subsequent precipitation events. The correction of deficiencies shall be at no additional cost to the Airport.

156-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Engineer.
156-3.3 Construction details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately if project conditions permit; otherwise, temporary erosion control measures may be required.

The Engineer shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor’s capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control features current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the Engineer.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the Engineer. If temporary erosion and pollution control measures are required due to the Contractor’s negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the Engineer, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The Engineer may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor during the construction period.

Whenever construction equipment must cross watercourses at frequent intervals, temporary structures should be provided.

Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

156-3.4 Installation, maintenance and removal of silt fences. Silt fences shall extend a minimum of 16 inches (41 cm) and a maximum of 34 inches (86 cm) above the ground surface. Posts shall be set no more than 10 feet (3 m) on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch (300-mm) overlap and securely sealed. A trench shall be excavated approximately 4 inches (100 mm) deep by 4 inches (100 mm) wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the Engineer.
METHOD OF MEASUREMENT

156-4.1 Temporary erosion and pollution control work required will be performed as scheduled or directed by the Engineer. Completed and accepted work will be measured for payment by the lump sum as a single complete unit of work.

156-4.2 Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor.

156-4.3 Computations for Contractor Monthly Pay Application. Monthly progress payments will be calculated by dividing the lump sum unit price by the contract time in months.

BASIS OF PAYMENT

156-5.1 Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the Engineer and measured as provided in paragraph 156-4.1 will be paid for under:

Item P-156-5.1 Prepare and Implement the Storm Water Pollution Prevention Plan and measures — per Lump Sum

MATERIAL REQUIREMENTS

ASTM D6461 Standard Specification for Silt Fence Materials
AC 150/5200-33 Hazardous Wildlife Attractants

END OF ITEM P-156
Item P-157 Cement Kiln Dust (CKD) Treated Subgrade

NOT USED

END OF ITEM P-157
Intentionally Left Blank
Item P-158 Fly Ash Treated Subgrade

NOT USED

END OF ITEM P-158
Part 3 – Flexible Base Courses

Item P-208 Aggregate Base Course

208-1.1 This item shall consist of a base course composed of course aggregate bonded with fine aggregate base. It shall be constructed on a prepared subgrade or subbase course per these specifications and shall conform to the dimensions and typical cross-section shown on the plans.

MATERIALS

208-2.1 Aggregate base. The aggregate base material shall consist of both fine and coarse aggregate. Material shall be clean, sound, durable particles and fragments of stone or gravel, crushed stone, or crushed gravel mixed or blended with sand, screenings, or other similar materials produced from approved sources. The aggregate shall be free from lumps of clay, organic matter, and other objectionable materials or coatings.

Crushed aggregate shall consist of clean, sound, durable stones and rock crushed to specified size and shall be free from excess soft or disintegrated pieces, dirt, or other objectionable matter. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as nearly constant and uniform as practicable.

The coarse aggregate portion, defined as the portion retained on the No. 4 sieve, shall not have a loss of greater than 50% when tested per ASTM C131. The sodium sulfate soundness loss shall not exceed 12%, or the magnesium sulfate soundness loss shall not exceed 18%, after five cycles, when tested in accordance with ASTM C88. The aggregate shall have at least 60% by weight of particles with at least two fractured faces and 75% with at least one fractured face per ASTM D5821. The area of each face shall be equal to at least 75% of the smallest mid-sectional 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. The aggregate shall contain no more than 15%, by weight, of flat, elongated, or flat and elongated particles per ASTM D4791. A flat particle is one having a ratio of width to thickness greater than three (3); an elongated particle is one having a ratio of length to width greater than three (3).

The fine aggregate portion, defined as the portion passing the No. 4 sieve, produced in crushing operations shall be incorporated in the base material to the extent permitted by the gradation requirements.

a. Sampling and testing for initial aggregate base requirements. Samples shall be taken by the Contractor in the presence of the Engineer. Material shall meet the requirements in paragraph 208-2.1 and 208-2.2. This sampling and testing will be the basis for approval of the aggregate base quality requirements. Testing for verification of the gradation shall be done by the Contractor’s Quality Control team on a daily basis (one work shift) and at a minimum of two samples per lot.

208-2.2 Gradation requirement. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine as defined by ASTM D2487 and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa. The fraction of material passing the No. 200 (0.075 mm) sieve shall not exceed one-half the fraction passing the No. 40 (0.45 mm) sieve. The portion of the filler and binder, including any blended material, passing the No. 40
(0.45 mm) sieve shall have a liquid limit not more than 25 and a plasticity index not more than five (5) when tested per ASTM D4318.

**Requirements for Gradation of Aggregate Base**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Design Range Percentage by Weight</th>
<th>Contractor’s Final Gradation</th>
<th>Job Control Grading Band Tolerances for Contractor’s Final Gradation Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch (50 mm)</td>
<td>--</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>1-1/2 inch (38 mm)</td>
<td>100</td>
<td></td>
<td>±5</td>
</tr>
<tr>
<td>1 inch (25 mm)</td>
<td>70-100</td>
<td></td>
<td>±8</td>
</tr>
<tr>
<td>3/4 inch (19 mm)</td>
<td>55-85</td>
<td></td>
<td>±8</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>30-60</td>
<td></td>
<td>±8</td>
</tr>
<tr>
<td>No. 40 (0.45 mm)</td>
<td>10-30</td>
<td></td>
<td>±5</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>5-15</td>
<td></td>
<td>±3</td>
</tr>
</tbody>
</table>

The “Job Control Grading Band Tolerances for Contractor’s Final Gradation” in the table shall be applied to “Contractor’s Final Gradation” to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

**a. Sampling and testing for gradation.** The Contractor shall take at least two aggregate base samples per lot to check the final gradation. Sampling shall be per ASTM D75. The lot will be consistent with the lot size used for density. The samples shall be taken from the in-place, un-compacted material in the presence of the Engineer. Sampling points and intervals will be designated by the Engineer.

**208-2.4 PROCESSED MISCELLANEOUS BASE.** Processed miscellaneous base shall consist of cold milled asphalt concrete obtained through the asphalt pavement removal of the existing bituminous pavement. The material retained on the No. 4 (4.75 mm) sieve shall contain no more than 75 percent gravel particles defined as gravel composed entirely of particles that have no more than one fractured face. The material shall be free of any detrimental quantity of deleterious material as defined as soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

Cold milled material shall only be produced through the operation of a machine specifically designed for cold milling asphalt pavements. Processed miscellaneous base shall not be produced by the operation of self propelled drum hammers (“stompers”), breakers, steel padded rollers, or by ripping or excavation equipment.

The contractor shall collect samples of the cold milled material in the presence of the Engineer for gradation and sand equivalent testing per 1,000 square yards of surface area completed. The contractor shall not place any subsequent lift of material until all gradation and sand equivalent testing has been performed and reported by the contractor’s quality control lab and accepted by the Engineer. Compaction testing shall per paragraphs 208-3.5 and 208-3.6.
Grading of processed miscellaneous base shall be uniformly graded and shall conform to the gradation outline in the following table.

**Requirements for Gradation of Processed Miscellaneous Base**

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percentage by weight passing sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch (50.0 mm)</td>
<td>100</td>
</tr>
<tr>
<td>1-1/2 inch (37.0 mm)</td>
<td>100</td>
</tr>
<tr>
<td>1 inch (25.0 mm)</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch (13.0 mm)</td>
<td>85-100</td>
</tr>
<tr>
<td>3/8 inch (9.5 mm)</td>
<td>55-80</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>35-60</td>
</tr>
<tr>
<td>No. 30 (0.60 mm)</td>
<td>10-30</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>2-9</td>
</tr>
<tr>
<td>ASTM C 131 Grading</td>
<td>B</td>
</tr>
</tbody>
</table>

If, after testing, the milled material does not conform to the gradation specified in the table above, a maximum of 35 percent rock product defined as crushed rock, rock dust, gravel sand, or any combination thereof that is clean, hard, sound, durable, uniform in quality, and free from any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substances. The Contractor shall determine the amount of rock material to be blended. The rock products shall be uniformly spread and blended over the area requiring correction of gradation. The equipment used for blending the material shall be the same equipment used to pulverize the material initially.

When there is a difference in specific gravity (bulk saturated surface dry conforming to ASTM C 127) of 0.2 or more between that portion retained and that portion passing the number 4 sieve, a modified grading will be required. The grading will be modified in accordance with California Test 105.

Quality requirements for this material shall conform to the requirements of the following table.
### Requirements for Testing Properties of Processed Miscellaneous Base

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Method No.</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-value</td>
<td>California 301</td>
<td>78 minimum</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>California 217</td>
<td>35 minimum</td>
</tr>
<tr>
<td>Percentage Wear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 revolutions</td>
<td></td>
<td>15 maximum</td>
</tr>
<tr>
<td>500 revolutions</td>
<td></td>
<td>52 maximum</td>
</tr>
</tbody>
</table>

1. The R-value requirement may be waived provided the material has an SE of 40 or more.

The Engineer may waive the percentage wear requirements provided the material has a minimum durability of 35 in accordance with California Test 229.

### 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 by the Engineer.

**208-3.2 Preparing underlying subgrade and/or subbase.** The underlying subgrade and/or subbase shall be checked and accepted by the Engineer before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with P-152, at the Contractor’s expense, may be required by the Engineer if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. 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 Production.** The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 208-3.5, the approved material may be transported directly to the spreading equipment.

**208-3.4 Placing.** The aggregate base material shall be placed and spread on the prepared underlying subgrade and/or subbase and compacted in layers to the thickness shown on the plans. Work shall progress without interruption. The material shall be deposited and spread in lanes in a uniform layer without segregation to such loose depth that, when compacted, the layer shall have the specified thickness. The aggregate base course shall be constructed in layers of uniform thickness of not less than 3 inches (75 mm) nor more than 6 inches (150 mm) 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 (1700 sq m) in advance of the rolling. Any necessary sprinkling shall be kept within these limits. Care shall be taken to prevent cutting into the underlying layer during spreading. No material shall be placed in snow or on a soft, muddy, or frozen course. The aggregate base material shall be spread by spreader boxes or other approved devices. This equipment shall have positive thickness controls that spread the aggregate in the required amount to avoid or minimize the need for hand manipulation. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.
When more than one layer is required, the construction procedure described here shall apply similarly to each layer.

208-3.5 Compaction. Immediately upon completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. 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 be within ±2 percentage points of the optimum moisture content as determined by ASTM D3017. If nuclear density machines are used for density determination, the field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated per ASTM D6938.

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 if it does not exceed 2400 square yards (2000 sq m). A lot will consist of one-half day’s production if a day’s production is between 2400 and 4800 square yards (2000 and 4000 sq m). The Contractor’s laboratory shall perform all density tests in the Engineer’s presence and provide the test results upon completion to the Engineer for acceptance. Each lot shall be divided into two equal sublots. One test shall be made for each sublot and shall consist of the average of two random locations for density determination. Sampling locations will be determined by the Engineer on a random basis per ASTM D3665.

Each lot shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D698. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. 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 tolerances. After the course has been 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 to a depth of at least 3 inches (75 mm), reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor’s expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8 inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Accuracy. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade.

208-3.8 Thickness control. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by surveys taken by the Contractor and verified by the Engineer. The surveys shall be required before and after placement of the base. The survey interval shall be on a maximum grid of 20-feet, and supplemented by additions survey points at all grade breaks or as directed by the Engineer. Where the thickness is deficient by more than 1/2 inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.
208-3.9 Protection. Perform construction when the atmospheric temperature is above 35°F (2°C). When the temperature falls below 35°F (2°C), protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements. When the aggregates contain frozen materials or when the underlying course is frozen or wet, the construction shall be stopped. Hauling equipment may be routed over completed portions of the base course, provided no damage results. Equipment shall be routed over the full width of the base course to avoid rutting or uneven compaction. The Engineer will stop all hauling over completed or partially completed base course when, in the Engineer’s opinion, such hauling is causing damage. Any damage to the base course shall be repaired by the Contractor at the Contractor’s expense.

208-3.10 Maintenance. The Contractor shall maintain the base course in a satisfactory condition until the full pavement section is completed and accepted by the Engineer. The surface shall be kept clean and free from foreign material and properly drained at all times. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any base course that is not paved over prior to the onset of winter shall be retested to verify that it still complies with the requirements of this specification. Any area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

Equipment used in the construction of an adjoining section may be routed over completed base course, if no damage results and the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

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 The quantity of for processed miscellaneous base course shall be measured by the number of square yards (square meters) of material actually constructed and accepted by the Engineer as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

208-4.2 No separate measurement or payment shall be made for the processing, hauling, placing, spreading and compacting of millings derived from the cold planning of existing pavement on the haul roads or the airport’s perimeter road; it shall be considered as a subsidiary obligation of the Contractor covered under the other contract items.

BASIS OF PAYMENT

208-5.1 Payment shall be made at the contract unit price per square yards (square meters) for processed miscellaneous base course. This price shall be full compensation for furnishing all materials and for all operations, hauling, placing, and compacting of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:
Item P-208-5.1 Processed Miscellaneous Base Course - per square yards (square meters)

TESTING REQUIREMENTS

ASTM C29 Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117 Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136 Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D75 Standard Practice for Sampling Aggregates
ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN-m/m³))
ASTM D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D3665 Standard Practice for Random Sampling of Construction Materials
ASTM D4718 Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D4791 Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821 Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-208
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Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base 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

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, or crushed gravel, and shall be free from coatings of clay, silt, organic material, or other objectionable materials. Aggregates shall contain no clay lumps or balls. Fine aggregate passing the No. 4 (4.75 mm) sieve shall consist of fines from the coarse aggregate crushing operation. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone, or gravel that meet the coarse aggregate requirements for wear and soundness.

The coarse aggregate portion, defined as the material retained on the No. 4 (4.75 mm) sieve, shall not have a loss of greater than 45% when tested per ASTM C131. The sodium sulfate soundness loss shall not exceed 12%, or the magnesium sulfate soundness loss shall not exceed 18%, after five cycles, when tested in accordance with ASTM C88. The aggregate shall contain no more than 15% by weight, of flat, elongated, or flat and elongated particles per ASTM D4791. A flat particle is one having a ratio of width to thickness greater than three (3); an elongated particle is one having a ratio of length to width greater than three (3). The aggregate shall have at least 90% by weight of particles with at least two fractured faces and 100% with at least one fractured face per ASTM D5821. The area of each face shall be equal to at least 75% of the smallest mid-sectional 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.

a. Sampling and testing for initial aggregate base requirements. Samples shall be taken by the Contractor in the presence of the Engineer prior to delivery of any materials to the site. Material shall meet the requirements in paragraph 209-2.1 and 209-2.2. This sampling and testing will be the basis for approval of the aggregate base quality requirements. At the sole discretion of the Engineer, additional sampling points may be required for quality requirements during the project.

209-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine as defined by ASTM D2487 and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa. The fraction of material passing the No. 200 (0.075 mm) sieve shall not exceed one-half the fraction passing the No. 40 (0.45 mm) sieve.
### Requirements For Gradation Of Aggregate Base

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Design Range Percentage by Weight</th>
<th>Contractor’s Final Gradation</th>
<th>Job Control Grading Band Tolerances for Contractor’s Final Gradation Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch (50 mm)</td>
<td>100</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1-1/2 inch (38 mm)</td>
<td>95-100</td>
<td>±5</td>
<td></td>
</tr>
<tr>
<td>1 inch (25 mm)</td>
<td>70-95</td>
<td>±8</td>
<td></td>
</tr>
<tr>
<td>3/4 inch (19 mm)</td>
<td>55-85</td>
<td>±8</td>
<td></td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>30-60</td>
<td>±8</td>
<td></td>
</tr>
<tr>
<td>No. 40 (0.45 mm)</td>
<td>10-30</td>
<td>±5</td>
<td></td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>0-8</td>
<td>±3</td>
<td></td>
</tr>
</tbody>
</table>

The “Job Control Grading Band Tolerances for Contractor’s Final Gradation” in the table shall be applied to “Contractor’s Final Gradation” to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

#### a. Sampling and testing for gradation.
Gradation tests shall be performed by the Contractor per ASTM C136 and sieve analysis on material passing the No. 200 sieve (75 mm) per ASTM C112. The Contractor shall take at least two (2) aggregate base samples per lot to check the final gradation. Sampling shall be per ASTM D75. The lot will be consistent with the lot size used for density. The samples shall be taken from the in-place, un-compacted material in the presence of the Engineer. Sampling points and intervals will be designated by the Engineer.

### CONSTRUCTION METHODS

#### 209-3.1 Preparing underlying subgrade and/or subbase
The underlying subgrade and/or subbase shall be checked and accepted by the Engineer before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with P-152, at the Contractor’s expense, may be required by the Engineer if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. No additional compensation shall be made, nor additional contract time allowed for these corrective measures. All corrective measures and any resulting quality assurance and quality control testing shall be at the sole expense of the Contractor. 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.

#### 209-3.2 Production
The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.4, the approved material may be transported directly to the spreading equipment.

#### 209-3.3 Placing
The aggregate base material shall be placed on the prepared underlying subgrade and/or subbase and compacted in layers to the thickness shown on the plans. Work shall progress without interruption. The material shall be deposited and spread in lanes in a uniform layer without segregation to such loose depth that, when compacted, the layer shall have the specified thickness. The aggregate base course shall be constructed in layers of uniform thickness of not less than 3 inches (75 mm) nor more than 6 inches (150 mm) 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 (1700 sq m) in advance of the rolling. Any necessary sprinkling shall be kept within these limits. Care shall be taken to prevent cutting into the underlying layer during spreading. No material shall be placed in snow or on a soft, muddy, or frozen course. The aggregate base material shall be spread by spreader boxes or other approved devices. This equipment shall have positive thickness controls that spread the aggregate in the required amount to avoid or minimize the need for hand manipulation. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

209-3.4 Compaction. Immediately after completion of the spreading operations, the Contractor shall compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM D6938.

209-3.5 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 if it does not exceed 2,400 square yards (2000 sq m). A lot will consist of one-half day’s production if a day’s production consists of between 2,400 and 4,800 square yards (2000 and 4000 sq m). The Contractor’s laboratory shall perform all density tests in the Engineer’s presence and provide the test results upon completion daily to the Engineer; the Engineer shall at the Engineer’s sole discretion, perform random quality assurance density tests in accordance with ASTM D1556 for verification of acceptance.

Each lot shall be divided into two equal sublots. One test shall be made for each sublot and shall consist of the average of two random locations for density determination. Sampling locations will be determined by the Engineer on a random basis per ASTM D3665.

Each lot will be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens. The specimens shall be compacted and tested per ASTM D1557. The calibration checks of both the density and moisture gages shall be made at the beginning of a production and at intervals as determined by the Engineer. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material except that one (1) test per lot shall be performed in accordance with ASTM D1556. Tests shall be in accordance with ASTM D4718 if greater than 30% is retained on the 3/4 inch sieve. The nuclear equipment used shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the entire sublot shall be reworked and/or recompacted and two additional random tests made at the Contractor’s expense. This procedure shall be followed until the specified density is reached.

209-3.6 Surface tolerances. After the course has been 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 to a depth of at least 3 inches (75 mm), reshaped and recompacted to grade, until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor’s expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8 inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously at half the length of the 12-foot (3.7-m) straightedge for the full length of
each line on a 50-foot (15-m) grid. The contractor shall provide a 12-foot (3.7-m) straightedge for the sole use of the Engineer.

b. Accuracy. The grade and crown shall be surveyed by a California licenced engineer or surveyor provided by the contractor, on a 25-foot (7.5-m) grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade. The survey shall be provided to the Engineer in electronic AutoCAD® Civil 3D 2013 format and a signed and sealed Adobe Acrobat® pdf format.

209-3.7 Thickness control. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by pre and post surveys performed by a California licenced engineer or surveyor provided by the Contractor. The surveys shall be performed on a 25-foot (7.5-m) grid starting from the crown; all pre and post survey locations shall concide horizontally. Depth tests shall also be taken by the contractor at intervals determined by the Engineer. Sampling locations will be determined by the Engineer per ASTM D3665. Where the thickness is deficient by more than 1/2 inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material of proper gradation, and the material shall be blended and recompahted to grade. Additional test holes may be required to identify the limits of deficient areas. The Contractor shall replace, at his expense, base material where depth tests have been taken.

209-3.8 Protection. Perform construction when the atmospheric temperature is above 35°F (2°C). When the temperature falls below 35°F (2°C), protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements. When the aggregates contain frozen materials or when the underlying course is frozen or wet, the construction shall be stopped. Hauling equipment may be routed over completed portions of the base course, provided no damage results. Equipment shall be routed over the full width of the base course to avoid rutting or uneven compaction. The Engineer will stop all hauling over completed or partially completed base course when, in the Engineer’s opinion, such hauling is causing damage or rutting of the surface. Any damage to the base course shall be repaired by the Contractor at the Contractor’s expense.

209-3.9 Maintenance. The Contractor shall maintain the base course in a satisfactory condition until the full pavement section is completed and accepted by the Engineer. The surface shall be kept clean and free from foreign material and properly drained at all times. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any base course that is not paved over prior to the onset of winter shall be retested to verify that it still complies with the requirements of this specification. Any area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

Equipment used in the construction of an adjoining section may be routed over completed base course, if no damage results and the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

The Contractor shall remove all survey and grade hubs from the base courses prior to placing any bituminous surface course.

METHOD OF MEASUREMENT

209-4.1 The quantity of crushed aggregate base course will be determined by measurement of the number of cubic yards (cubic meters) of material actually constructed and accepted by the Engineer as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.
**BASIS OF PAYMENT**

**209-5.1** Payment shall be made at the contract unit price per cubic yard (cubic meter) for crushed 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:

Item P-209-5.1 Crushed Aggregate Base Course - per cubic yard (cubic meter)

**TESTING REQUIREMENTS**

- ASTM C29 Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
- ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- ASTM C136 Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
- ASTM D75 Standard Practice for Sampling Aggregates
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
- ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
- ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN-m/m³))
- ASTM D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- ASTM D3665 Standard Practice for Random Sampling of Construction Materials
- ASTM D4718 Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
- ASTM D4791 Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- ASTM D5821 Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
- ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

**END OF ITEM P-209**
Intentionally Left Blank
Item P-210 Caliche Base Course

NOT USED

END OF ITEM P-210
Intentionally Left Blank
Item P-211 Lime Rock Base Course

NOT USED

END OF ITEM P-211
Intentionally Left Blank
Item P-212 Shell Base Course

NOT USED

END OF ITEM P-212
Item P-213 Sand-Clay Base Course

NOT USED

END OF ITEM P-213
Item P-217 Aggregate-Turf Pavement

NOT USED

END OF ITEM P-217
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Item P-219 Recycled Concrete Aggregate Base Course

NOT USED

END OF ITEM P-219
Part 4 – Rigid Base Courses

Item P-301 Soil-Cement Base Course

NOT USED

END OF ITEM P-301
Intentionally Left Blank
Item P-304 Cement-Treated Base Course

NOT USED

END OF ITEM P-304
Intentionally Left Blank
Item P-306 Lean Concrete Base Course

NOT USED

END OF ITEM P-306
Part 5 – Flexible Surface Courses

Item P-401 Hot Mix Asphalt (HMA) Pavements

DESCRIPTION

401-1.1 This item shall consist of pavement courses composed of mineral aggregate and asphalt cement binder (asphalt binder) 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, natural sand and mineral filler, as required. The aggregates should be free of ferrous sulfides, such as pyrite, that would cause “rust” staining that can bleed through pavement markings. The portion retained on the No. 4 (4.75 mm) sieve is coarse aggregate. The portion passing the No. 4 (4.75 mm) sieve and retained on the No. 200 (0.075 mm) sieve is fine aggregate, and the portion passing the No. 200 (0.075 mm) sieve is mineral filler.

The Contractor shall prevent the inclusion of any aggregates containing ferrous sulfides or iron oxides in the mix. All aggregates to be used in the asphalt pavement shall be tested for ferrous sulfides and iron oxides content. The test procedure shall require the immersion of samples of the aggregates in a lime slurry to identify staining particles. If a blue-green gelatinous precipitate forms within five (5) to ten (10) minutes, rapidly changing to a brown color on exposure to air and light, the aggregate shall be deemed unacceptable. Aggregates observed to have no brown gelatinous precipitate forms shall be deemed acceptable.

a. Coarse aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the bituminous material and free from organic matter and other deleterious substances. The percentage of wear shall not be greater than 40% when tested in accordance with ASTM C131. The sodium sulfate soundness loss shall not exceed 12%, or the magnesium sulfate soundness loss shall not exceed 18%, after five cycles, when tested in accordance with ASTM C88. Clay lumps and friable particles shall not exceed 1.0% when tested in accordance with ASTM C142.

Aggregate shall contain at least 75 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% 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 achieved by crushing.

The aggregate shall not contain more than a total of 8%, by weight, of flat particles, elongated particles, and flat and elongated particles, when tested in accordance with ASTM D4791 with a value of 5:1.
All coarse aggregate to be used in the work shall have a minimum cleanliness value (CV) of 75 as determined by California Test 227.

The contractor shall ensure: 1) that all course aggregate to be used in the work meets the minimum CV; and 2) that all course aggregates to be used in the work shall be washed.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, 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.

The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

The soundness loss shall not exceed 10% when sodium sulfate is used or 15% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

Clay lumps and friable particles shall not exceed 1.0%, by weight, when tested in accordance with ASTM C142.

Natural (non-manufactured) 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% natural sand by weight of total aggregates. If used, the natural sand shall meet the requirements of ASTM D1073 and shall have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

The aggregate shall have sand equivalent values of \(45\) or greater when tested in accordance with ASTM D2419.

Fine aggregate to be used in the work shall be washed prior to incorporation into the mix.

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler.

d. Verification testing. The Contractor shall provide representative samples (min 50lbs) of the aggregates and mineral filler if applicable, to be used in the hot mixed asphalt for verification testing. The samples shall be provided to the Engineer’s testing laboratory and prior to submitting the Job Mix Formula. If an aggregate source is changed during the project, the contractor shall submit representative samples of the new aggregates prior to incorporation into the project. All aggregate samples shall be processed the same way as the aggregate to be used in the work, and all aggregate verification testing costs performed by the Engineer shall be borne by the Contractor.

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 D242.

401-2.3 Asphalt cement binder. Asphalt cement binder shall conform to ASTM D6373 Performance Grade (PG) \(76-22\) polymer modified (PM). A certificate of compliance from the manufacturer shall be included with the mix design submittal.

A PG Plus Test shall be provided by the manufacture showing that the asphalt cement binder has been properly modified. This test shall show the asphalt cement binder has a minimum elastic recovery of 70% per ASTM D6084. Use of polyphosphoric acid (PPA) to modify PG asphalt cement binder properties is prohibited for mixtures containing limestone, limestone as an aggregate blend component, or limestone as a constituent in crushed gravel aggregate. This prohibition also applies to the use of PPA as a cross-linking agent for polymer modification.
401-2.4 Preliminary material acceptance. Prior to delivery of materials to the job site and prior to submittal of the Job Mix Formula, the Contractor shall submit certified test reports to the Engineer for the following materials:

a. Coarse aggregate:
   (1) Percent of wear
   (2) Soundness
   (3) Clay lumps and friable particles
   (4) Percent fractured faces
   (5) Flat and elongated particles
   (6) Cleanliness value (CV)
   (7) Lime slurry test for ferrous sulfides and iron oxides

b. Fine aggregate:
   (1) Liquid limit and Plasticity index
   (2) Soundness
   (3) Clay lumps and friable particles
   (4) Percent natural sand
   (5) Sand equivalent
   (6) Lime Slurry test for ferrous sulfides and iron oxides

c. Mineral filler.

d. Asphalt binder. Test results for asphalt binder shall include temperature/viscosity charts for mixing and compaction temperatures.

The certifications shall show the appropriate ASTM tests 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.

Prior to delivery of materials to the job site the Contractor shall submit to the Engineer a certification of compliance that all aggregates to be used in the work are washed prior to incorporation into the HMA mix.

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 California Department of Transportation (Caltrans). If anti-stripping agent is to be used, the Contractor shall provide product and manufacture/supplier information on the intended anti-stripping agent with the JMF submittal.
COMPOSITION

401-3.1 Composition of mixture. The HMA mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and asphalt binder. 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 (JMF). No hot-mixed asphalt (HMA) for payment shall be produced until a JMF has been approved in writing by the Engineer. The asphalt mix-design and JMF shall be prepared by an accredited laboratory that meets the requirements of paragraph 401-3.4. The HMA shall be designed using procedures contained in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples shall be prepared at various asphalt contents and compacted using the gyratory compactor in accordance with ASTM D6925.

Tensile strength ratio (TSR) of the composite mixture, as determined by ASTM D4867, shall not be less than 75 when tested at a saturation of 70-80% or an anti-stripping agent shall be added to the HMA, as necessary, to produce a TSR of not less than 75 when tested at a saturation of 70-80%. If an anti-strip agent is required, it shall be provided by the Contractor at no additional cost to the Owner.

The JMF shall be submitted in writing by the Contractor at least 20 calendar days prior to the start of paving operations. The JMF shall be developed within three (3) months of the submittal date using aggregates currently being produced.

The submitted JMF shall be stamped and sealed by the responsible and currently registered California Professional Engineer from the laboratory developing the JMF and shall include the following items 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 grade and type of modifier if used.

d. Number of gyrations.

e. Laboratory mixing temperature.

f. Laboratory compaction temperature.

g. Temperature-viscosity relationship of the PG asphalt cement binder showing acceptable range of mixing and compaction temperatures; and for modified binders include supplier recommended mixing and compaction temperatures.

h. Plot of the combined gradation on a 0.45 power gradation curve.

i. Graphical plots of air voids, voids in the mineral aggregate, voids filled with asphalt, and unit weight versus asphalt content.

j. Specific Gravity and absorption of each aggregate.

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. Anti-strip agent (if required).
p. Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season or more than three (3) months old shall not be accepted.

q. Cleanliness Value (CV) of aggregate.

r. Asphalt film thickness.

s. The extraction oven calibration testing certification for the mix design, used for determining the asphalt content per paragraph 401-6.3a.

t. Dust to asphalt ratio (using effective asphalt content).

u. Calibration verification for the gyratory compactor used in developing the mix design. The calibration shall: i) have been performed no more than three (3) months prior to the JMF submittal date; and ii) shall be performed if the gyratory compactor has been transported to a new location for developing the JMF.

v. The firm’s name and contact information for the independent testing organization performing the calibration of the contractor provided laboratory equipment per paragraph 401-5.1 below.

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 JMF requirements specified in Tables 1 and 3.

When the project requires asphalt mixtures of differing aggregate gradations, a separate JMF and the results of JMF verification testing shall be submitted for each mix.

The JMF 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 JMF must be submitted within 15 days and approved by the Engineer in writing before the new material is used. After the initial production JMF has been approved by the Engineer and a new or modified JMF is required for whatever reason, the subsequent cost of the Engineer’s approval of the new or modified JMF 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 JMF.

The Gyratory Design Criteria applicable to the project shall meet the criteria specified in Table 1.

Table 1. Gyratory Compaction Criteria

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of compactor gyrations</td>
<td>75</td>
</tr>
<tr>
<td>Air voids (%)</td>
<td>3.5</td>
</tr>
<tr>
<td>Film thickness, minimum</td>
<td>8 microns</td>
</tr>
<tr>
<td>Voids filled with asphalt</td>
<td>65-78</td>
</tr>
<tr>
<td>Dust to effective asphalt content ratio</td>
<td>0.6 – 1.2</td>
</tr>
<tr>
<td>Percent voids in mineral aggregate, minimum</td>
<td>See Table 2</td>
</tr>
</tbody>
</table>
Note: The film thickness shall be calculated at each asphalt content from the asphalt content and surface area of aggregate, using computational methods described in the National Center for Asphalt Technology (NCAT) Report 98-1, ‘A Critical Review of VMA Requirements in Superpave, except that the effective asphalt content shall be used in the computation.

### Table 2. Minimum Percent Voids In Mineral Aggregate (VMA)

<table>
<thead>
<tr>
<th>Aggregate (See Table 3)</th>
<th>Minimum VMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradation 2</td>
<td>15.0%</td>
</tr>
</tbody>
</table>

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 C136 and ASTM C117.

The gradations in Table 3 represent the limits that shall determine the suitability of aggregate for use from the sources of supply; 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 sieve, or vice versa.

### Table 3. Aggregate - HMA Pavements

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by Weight Passing Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gradation 2</td>
</tr>
<tr>
<td>1 inch (25 mm)</td>
<td>--</td>
</tr>
<tr>
<td>3/4 inch (19 mm)</td>
<td>100</td>
</tr>
<tr>
<td>1/2 inch (12 mm)</td>
<td>79-99</td>
</tr>
<tr>
<td>3/8 inch (9 mm)</td>
<td>68-88</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>48-68</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>33-53</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>20-40</td>
</tr>
<tr>
<td>No. 30 (0.60 mm)</td>
<td>14-30</td>
</tr>
<tr>
<td>No. 50 (0.30 mm)</td>
<td>9-21</td>
</tr>
<tr>
<td>No. 100 (0.15 mm)</td>
<td>6-16</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>3-6</td>
</tr>
<tr>
<td>Asphalt Percent</td>
<td>5.0-7.5</td>
</tr>
</tbody>
</table>

Note 1: Material passing the No. 200 sieve may consist of fine particles of aggregate, mineral filler, or both. Material passing the No. 30 sieve shall be non-plastic when tested in accordance with the requirements of ASTM D4318.

Note 2: If the aggregate does not satisfy tensile strength ratio requirements, add appropriate amount of an approved anti-stripping agent.

Note 3: Job mix formula shall follow a smooth curve within the specified limits for all sieve sizes of Table 3, but should not fall on the maximum density line for any portion except at one crossing point, and shall cross the maximum density line above the No. 4 sieve.
Note 4: Notify the Engineer in writing if a satisfactory job mix formula using Table 3 cannot be obtained.

Note 5: Dust is defined as the amount of material passing the No. 200 sieve.

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 MS-2 Mix Design Manual, 7th Edition.

401-3.3 Reclaimed asphalt pavement (RAP). RAP shall not be used.

401-3.4 Job mix formula (JMF) laboratory. The Contractor’s laboratory used to develop the JMF shall be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority’s website. All test methods required for developing the JMF must be listed on the lab accreditation. A copy of the laboratory’s current accreditation and accredited test methods shall be submitted to the Engineer prior to the JMF submittal.

401-3.5 Test section. Prior to full production, the Contractor shall prepare and place a quantity of HMA according to the JMF. The amount of HMA shall be sufficient to construct a test section 300-feet long and 25-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 for this test section is an exposed construction joint at least four (4) hours old or whose mat has cooled to less than 160°F (71°C). The cold joint must be cut back using the same procedure that will be used during production in accordance with 401-4.13. 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 test section shall be placed in the area designated on the Plans unless otherwise directed by the Engineer. 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 401-5.2. The test section shall be divided into equal sublots. As a minimum the test section shall consist of three (3) sublots.

The test section shall be considered acceptable if (1) mat density, air voids, and joint density are 90% 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.

The test section’s gradation and asphalt content testing for determination of acceptance shall be performed by the Engineer. One (1) asphalt content test shall be performed per sublot in accordance with ASTM D6307 or ASTM D2172 if the correction factor in ASTM D6307 is greater than 1.0. The asphalt content for each sublot will be used in the VMA calculations for the particular sublot. The Engineer shall determine the aggregate gradations per sublot from mechanical analysis of extracted aggregate in accordance with ASTM D5444, ASTM C136, and ASTM C117. The Engineer’s gradation and asphalt content testing will be performed at the laboratory facilities provided by the Contractor at the plant except that at the sole discretion of the Engineer, the asphalt content testing per ASTM D2172 may be carried out at the Engineer’s laboratory facilities.

If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, 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 test 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 JMF. 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 asphalt content determined in the same manner as for the original JMF 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.

CONSTRUCTION METHODS

401-4.1 Weather limitations. The HMA 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>
<thead>
<tr>
<th>Mat Thickness</th>
<th>Base Temperature (Minimum)</th>
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<td>°F</td>
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<tr>
<td>3 inches (7.5 cm) or greater</td>
<td>40</td>
</tr>
<tr>
<td>Greater than 2 inches (50 mm) but less than 3 inches (7.5 cm)</td>
<td>45</td>
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401-4.2 HMA plant. Plants used for the preparation of HMA shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 with the following changes:

Requirements for all plants include:

a. Truck scales. The HMA 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, subsection 90-01.

In lieu of scales, and as approved by the Engineer, HMA weight may be determined by the use of an electronic weighing system equipped with an automatic printer that weighs the total HMA production and as often thereafter as requested by the Engineer.

b. Testing facilities. The Contractor shall ensure laboratory facilities are provided at the plant for the use of the Engineer. The lab shall have sufficient space and equipment so that both testing representatives (Engineer’s and Contractor’s) can operate efficiently. The lab shall meet the requirements of ASTM D3666 including all necessary equipment, materials, calibrations, current reference standards to comply with the specifications and a masonry saw with diamond blade for trimming pavement cores and samples.

The plant testing laboratory shall have a floor space area of not less than 200 square feet (18.5 sq m), with a ceiling height of not less than 7-1/2 feet (2 m). The laboratory shall be weather tight, sufficiently heated in cold weather, air-conditioned in hot weather to maintain temperatures for testing purposes of 70°F ±5°F (21°C ±2.3°C). 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. In addition, the facility shall include the minimum:

1. Adequate artificial lighting.
2. Electrical outlets sufficient in number and capacity for operating the required testing equipment and drying samples.
3. A minimum of two (2) Underwriter’s Laboratories approved fire extinguishers of the appropriate types and class.
4. Work benches for testing.
5. Desk with chairs and file cabinet.
6. Sanitary facilities convenient to testing laboratory.
7. Exhaust fan to outside air.
8. Sink with running water.

Failure to provide the specified facilities shall be sufficient cause for disapproving HMA plant operations.

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 quality control testing personnel and procedures. When in the opinion of the Engineer, 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. No addition compensation will be made nor additional contract time allowed for the suspension of paving operations due to deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures.

c. 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.

d. Storage bins and surge bins. The HMA stored in storage and surge bins shall meet the same requirements as HMA loaded directly into trucks and may be permitted under the following conditions:

1. Stored in non-insulated bins for a period of time not to exceed three (3) hours.
2. Stored in insulated bins for a period of time not to exceed eight (8) hours.

If the Engineer determines that there is an excessive amount of heat loss, segregation, or oxidation of the HMA due to temporary storage, no temporary storage will be allowed.

401-4.3 Hauling equipment. Trucks used for hauling HMA shall have tight, clean, and smooth metal beds. To prevent the HMA from sticking to the truck beds, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the Engineer. 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.

401-4.3.1 Material transfer vehicle (MTV). Material transfer vehicles used to transfer the material from the hauling equipment to the paver, shall use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to
the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation.

401-4.4 HMA pavers. HMA pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of HMA 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 HMA 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.

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.

401-4.4.1 Automatic grade controls. The HMA 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 ±0.1%.

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 m) in length.

b. Taut string-line (wire) set to grade.

c. Short ski or shoe.

d. Laser control.

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 HMA. The number, type, and weight of rollers shall be sufficient to compact the HMA to the required density while it is still in a workable condition.

All rollers shall be specifically designed and suitable for compacting HMA 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 their own expense.

The use of equipment that causes crushing of the aggregate will not be permitted.

401-4.6. Density device. The Contractor shall have on site a density gauge 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 gauge and obtain accurate density readings for all new HMA. These densities shall be supplied to the Engineer upon request at any time during construction and shall be recorded in technician’s field notes. The technician field notes shall also record the following information: the rolling pattern employed, all types of rollers used along with the speed of rolling, and the frequency and amplitude employed on the vibratory steel wheel rollers. The Engineer shall be provided a copy of these fields notes at the end of every paving shift. No separate payment will be made for supplying the density gauge, field notes, and technician.
401-4.7 Preparation of asphalt binder. The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt binder to the mixer at a uniform temperature. The temperature of unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325°F (160°C) when added to the aggregate. The temperature of modified asphalt binder shall be in accordance with the supplier’s suggested mixing temperature range but shall be no more than 350°F (175°C) when added to the aggregate.

401-4.8 Preparation of mineral aggregate. The aggregate for the HMA shall be heated and dried. 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°F (175°C) when the asphalt binder 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.

401-4.9 Preparation of HMA. The aggregates and the asphalt binder shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder 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 D2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% 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 HMA upon discharge shall not exceed 0.5%.

401-4.10 Preparation of the underlying surface. Immediately before placing the HMA, the underlying course shall be cleaned of all dust and debris. A prime coat and tack coat shall be applied in accordance with Item P-602 or Item P-603, if shown on the plans.

401-4.11 Laydown plan, transporting, placing, and finishing. Prior to the placement of the HMA, 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 locations, and laydown temperature. The laydown plan shall also include estimated time of completion for each portion of the work (that is, milling, paving, rolling, cooling, etc.). Modifications to the laydown plan shall be approved by the Engineer.

The HMA 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 HMA 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 shall use a material transfer vehicle to deliver HMA to the paver.

The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose for the first lift of all runway and taxiway pavements. Successive lifts of HMA surface course may be placed using a ski, or laser control per paragraph 401-4.4.1, provided grades of the first lift of HMA surface course meet the tolerances of paragraphs 401-5.2b(6) as verified by a survey. Contractor shall survey each lift of HMA 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.

The initial placement and compaction of the HMA shall occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 250°F (121°C).
Edges of existing HMA pavement abutting the new work shall be saw cut and carefully removed as shown on the drawings and coated with asphalt tack coat before new material is placed against it.

Upon arrival, the HMA shall be placed to the full width by a HMA 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 HMA mat. Unless otherwise permitted, placement of the HMA shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The HMA shall be placed in consecutive adjacent strips having a minimum width of \(12.5\, (3.81)\) feet (m) 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 (30 cm), in addition the longitudinal joint in a new course shall offset the longitudinal joint in the existing pavement immediately below by at least 1 foot (30 cm) if applicable; 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 (3 m) from transverse joints in the previous course.

Transverse joints in adjacent lanes shall be offset a minimum of 10 feet (3 m).

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the HMA 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 sole expense. The area shall be removed by saw cutting and milling a minimum of 3 inches (75 mm) deep for the top lift, and the entire thickness of the bottom lift as applicable. The area to be removed and replaced shall be a minimum width of 12.5 (3.81) feet (m) or the entire paving lane whichever is greater, and a minimum of 25 feet (7.6 m) long.

401-4.12 Compaction of HMA. After placing, the HMA shall be thoroughly and uniformly compacted by power rollers. The surface shall be compacted as soon as possible when the HMA 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 HMA 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 (125 kg), have a tamping plate width not less than 15 inches (38 cm), be rated at not less than 4,200 vibrations per minute, and be suitably equipped with a standard tamping plate wetting device.

Any HMA 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.

401-4.13 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 HMA 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 coated with an asphalt tack coat before placing any fresh HMA against the joint.

Longitudinal joints which have been left exposed for more than four (4) hours; the paving mat surface temperature has cooled to less than 175°F (80°C); or are irregular, damaged, uncompacted or otherwise defective shall be cut back 3 inches (75 mm) to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material shall be removed from the project. Asphalt tack coat or other product approved by the Engineer shall be applied to the clean, dry joint, prior to placing any additional fresh HMA against the joint. Any laitance produced from cutting joints shall be removed by vacuuming and washing. The cost of this work including the residual/discarded joint cutback material, shall be considered incidental to the cost of the HMA and no additional compensation shall be made therefor.

401-4.14 Saw-cut grooving. If shown on the plans, saw cut grooves shall be provided as specified in Item P-621.

401-4.15 Diamond grinding. When required, diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive. The saw blades shall be assembled in a cutting head mounted on a machine designed specifically for diamond grinding that will produce the required texture and smoothness level without damage to the pavement. The saw blades shall be 1/8-inch (3-mm) wide and there shall be a minimum of 55 to 60 blades per 12 inches (300 mm) of cutting head width; the actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Each machine shall be capable of cutting a path at least 3 feet (0.9 m) wide. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the pavement will not be permitted. The depth of grinding shall not exceed 1/2 inch (13mm) and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. Areas that have been ground will be sealed with a P-608 surface treatment as directed by the Engineer. It may be necessary to seal a larger area to avoid surface treatment creating any conflict with runway or taxiway markings.

401-4.16 Nighttime paving requirements. 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 (9 m) wide by 30 feet (9 m) long immediately behind the paving machines during the operations of the machines.

      (2) An area 15 feet (4.5 m) wide by 30 feet (9 m) long immediately in front and back of all rolling equipment, during operation of the equipment.

      (3) An area 15 feet (4.5 m) wide by 15 feet (4.5 m) 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. A lighting plan must be submitted by the Contractor and approved by the Engineer prior to the start of any nighttime work.
If the Contractor places any out of specification mix in the project work area, the Contractor shall be required to remove it at its own expense, to the satisfaction of the Engineer. If the Contractor has to continue placing non-payment HMA, 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.

MATERIAL ACCEPTANCE

401-5.1 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 except that coring and profilograph testing as required in this section shall be completed and paid for by the Contractor.

Testing organizations performing these tests except profilograph, shall be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority’s website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory’s current accreditation and accredited test methods shall be submitted to the Engineer prior to start of construction. All equipment in Contractor furnished laboratories shall be calibrated by an independent testing organization prior to the start of paving operations at the Contractor’s sole expense. The Contractor shall, at no additional cost and to the satisfaction of the Engineer, provide the Engineer with the following: 1) evidence of the Contractor furnished laboratories equipment calibration to include but not be limited to a copy of all calibration certifications for the subject equipment; 2) calibration verification for the gyratory compactor to be used for quality assurance testing, the gyratory compactor calibration shall have been performed no more than three (3) months prior to the start of paving operations and shall be performed if the gyratory compactor has been transported or moved to a new location; and 3) written confirmation in the form of a letter signed and sealed by a CA registered Professional Engineer from the independent testing organization stating that all equipment has been calibrated in accordance with the appropriate standards and identifying said standards. The organization performing the independent testing of the Contractor’s laboratory equipment shall be acceptable to the Engineer and the Engineer’s decision shall be final. If the Contractor fails to provide an independent testing organization acceptable to the Engineer, the Engineer shall employ the services of an appropriated qualified organization and all costs for said services shall be borne by the Contractor.

a. Hot mixed asphalt. Plant-produced HMA shall be tested for 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 D979.

A standard lot shall be equal to one day’s production or 2000 tons (1814 metric tons) whichever is smaller. If the day’s production is expected to exceed 2000 tons (1814 metric tons), but less than 4000 tons (3628 metric tons), the lot size shall be ½ day’s production. If the day’s production exceeds 4000 tons (3628 metric tons), the lot size shall be an equal sized fraction of the day’s production, but shall not exceed 2000 tons (1814 metric tons).

Where more than one plant is simultaneously producing HMA for the job, the lot sizes shall apply separately for each plant.
(1) Sampling. Each lot will consist of four equal sublots. Sufficient HMA 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 D3665. Samples will be taken in accordance with ASTM D979.

The sample of HMA may be put in a covered metal tin and placed in an oven for not less than 30 minutes nor more than 60 minutes to stabilize to compaction temperature. The compaction temperature of the specimens shall be as specified in the JMF.

(2) Testing. Air voids will be determined by the Engineer in accordance with ASTM D3203. One set of laboratory compacted specimens will be prepared for each sublot in accordance with ASTM D6925 at the number of gyrations required by paragraph 401-3.2, Table 1. Each set of laboratory compacted specimens will consist of three test specimens prepared from the same sample.

Prior to testing, the bulk specific gravity of each test specimen shall be measured by the Engineer in accordance with ASTM D2726 using the procedure for laboratory-prepared thoroughly dry specimens 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 D2041. The value used in the air voids computation for each sublot shall be based on theoretical maximum specific gravity measurement for the sublot.

(3) Acceptance. Acceptance of plant produced HMA for air voids shall be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b.

b. In-place HMA. HMA placed in the field shall be tested for mat and joint density on a lot basis. A standard lot shall be equal to one day’s production or 2000 tons (1814 metric tons) whichever is smaller. If the day’s production is expected to exceed 2000 tons (1814 metric tons), but less than 4000 tons (3628 metric tons), the lot size shall be 1/2 day’s production. If the day’s production exceeds 4000 tons (3628 metric tons), the lot size shall be an equal sized fraction of the day’s production, but shall not exceed 2000 tons (1814 metric tons).

(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 HMA 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 D3665. Cores for mat density shall not be taken closer than one foot (30 cm) 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 HMA as defined in paragraph 401-5.1a. The lot shall be divided into four equal sublots. One core of finished, compacted HMA 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 D3665. All cores for joint density shall be taken centered on the joint. The minimum core diameter for joint density determination shall be 5 inches (125 mm).

(3) Sampling. Samples shall be neatly cut with a diamond core drill bit. Samples will be taken in accordance with ASTM D979. The minimum diameter of the sample shall be 5 inches (125 mm). 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. Laitance produced by the coring operation shall be removed immediately.

The top most lift of HMA shall be completely bonded to the underlying layer. If any of the cores reveal that the surface is not bonded to the layer immediately below the surface then additional cores shall be taken as directed by the Engineer in accordance with paragraph 401-5.1b to determine the extent of any delamination. All delaminated areas shall be completely removed by milling to the limits and depth and replaced as directed by the Engineer at no additional cost.
(4) Testing. The bulk specific gravity of each cored sample will be measured by the Engineer in accordance with ASTM D2726. Samples will be taken in accordance with ASTM D979. 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 HMA 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 by the Engineer in accordance with the requirements of paragraph 401-5.2b(3).

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 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, that is, 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. 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, that is, n = 3.

401-5.2 Acceptance criteria.

a. General. Acceptance will be based on the following characteristics of the HMA and completed pavement as well as the implementation of the Contractor Quality Control Program and test results:

(1) Air voids
(2) Mat density
(3) Joint density
(4) Thickness
(5) Smoothness
(6) Grade

Mat density and air voids will be evaluated for acceptance in accordance with paragraph 401-5.2b(1). 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(7).

The Engineer may at any time, reject and require the Contractor to dispose of any batch of HMA 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%, the lot shall be acceptable. Acceptance and payment shall be determined in accordance with paragraph 401-8.1.

(3) Joint density. Acceptance of each lot of plant produced HMA for joint density shall be based on the PWL. If the PWL of the lot is equal to or exceeds 90%, the lot shall be considered acceptable. If the PWL is less than 90%, the Contractor shall evaluate the reason and act accordingly. If the PWL is less than 80%, the Contractor shall cease operations and until the reason for poor compaction has been determined. If the PWL is less than 71%, the pay factor for the lot used to complete the joint shall be reduced by five (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 1/4 inch (6 mm) 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. After the final rolling, but not later than 24 hours after placement, the surface of each lot shall be tested in both longitudinal and transverse directions for smoothness to reveal all surface irregularities exceeding the tolerances specified. The Contractor shall furnish paving equipment and employ methods that produce a surface for each pavement lot having an average profile index meeting the requirements of paragraph 401-8.1d when evaluated with a profilograph; and the finished surface course of the pavement shall not vary more than 1/4 inch (6mm) when evaluated with a 12-foot (3.7m) straightedge. The contractor shall provide a 12-foot (3.7m) straightedge for the sole of the Engineer and for the duration of the project. When the surface course smoothness exceeds specification tolerances which cannot be corrected by diamond grinding of the surface course, full depth removal and replacement of surface course corrections shall be to the limit of the longitudinal placement. Corrections involving diamond grinding will be subject to the final pavement thickness tolerances specified. The Contractor shall apply a surface treatment per Item P-608 or P-609 to all areas that have been subject to grinding as directed by the Engineer.

(a) Transverse measurements. Transverse measurements will be taken for each lot placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet (15m) or more often as determined by the Engineer.

(i) Testing shall be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope transitions. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. High spots on final surface course > 1/4 inch (6mm) in transverse direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.
(ii) The joint between lots shall be tested separately to facilitate smoothness between lots. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface, with half the straightedge on one side of the joint and the other half of the straightedge on the other side of the joint. Measure the maximum gap between the straightedge and the pavement surface in the area between these two high points. One measurement shall be taken at the joint every 50 feet (15m) or more often if directed by the Engineer. Deviations on final surface course > 1/4 inch (6mm) in transverse direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Each measurement shall be recorded and a copy of the data shall be furnished to the Engineer at the end of each day's testing.

(b) Longitudinal measurements. Longitudinal measurements will be taken for each lot placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet (6m); and at the third points of paving lanes when widths of paving lanes are 20 ft (6m) or greater.

(i) Longitudinal Short Sections. Longitudinal Short Sections are when the longitudinal lot length is less than 200 feet (60m) and areas not requiring a profilograph. When approved by the Engineer, the first and last 15 feet (4.5m) of the lot can also be considered as short sections for smoothness. The finished surface shall not vary more than 1/4 inch (6mm) when evaluated with a 12-foot (3.7m) straightedge. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope transitions. Testing shall be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Deviations on final surface course > 1/4 inch (6mm) in longitudinal direction will be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

(ii) Profilograph Testing. Profilograph testing shall be performed by the contractor using approved equipment and procedures as described as ASTM E1274. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2 inch (5 mm) blanking band. The bump template must span one inch (25 mm) with an offset of 0.4 inches (10 mm). The profilograph must be calibrated prior to use and operated by a factory or State DOT approved operator. Profilograms shall be recorded on a longitudinal scale of one inch (25 mm) equals 25 feet (7.5 m) and a vertical scale of one inch (25 mm) equals one inch (25 mm). A copy of the reduced tapes shall be furnished to the Engineer at the end of each day's testing.

The pavement must have an average profile index meeting the requirements of paragraph 401-8.1d. High spots, or “must grind” spots, on final surface course in longitudinal direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

Where corrections are necessary, second profilograph runs shall be performed to verify that the corrections produced an average profile index of 15 inches (38 cm) per mile or less. If the initial average profile index was less than 15 inches (38 cm), only those areas representing greater than 0.4 inch (10 mm) deviation will be re-profiled for correction verification.
(iii) Final profilograph of the runway. Final profilograph, full length of runway, shall be performed to facilitate testing of smoothness between lots. Profilograph testing shall be performed by the contractor using approved equipment and procedures as described as ASTM E1274. The pavement must have an average profile index meeting the requirements of paragraph 401-8.1d. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2 inch (5 mm) blanking band. The bump template must span one inch (25 mm) with an offset of 0.4 inches (10 mm). The profilograph must be calibrated prior to use and operated by a factory or State DOT approved, trained operator. Profilograms shall be recorded on a longitudinal scale of one inch (25 mm) equals 25 feet (7.5 m) and a vertical scale of one inch (25 mm) equals one inch (25 mm). A copy of the reduced tapes shall be furnished to the Engineer at the end of each days testing. Profilograph of final runway shall be performed one foot right and left of runway centerline and 15 feet (4.5 m) right and left of centerline. Any areas that indicate “must grind” will be corrected as directed by the Engineer.

Smoothness testing indicated in the above paragraphs except paragraph (iii) shall be performed within 24 hours of placement of material. Smoothness testing indicated in paragraph (iii) shall be performed within 48 hours of paving completion. The primary purpose of smoothness testing is to identify areas that may be prone to ponding of water which could lead to hydroplaning of aircraft. If the contractor’s machines and/or methods are producing significant areas that need corrective actions then production should be stopped until corrective measures can be implemented. If corrective measures are not implemented and when directed by the Engineer, production shall be stopped until corrective measures can be implemented.

(6) Grade. Grade shall be evaluated on the first day of placement and then as a minimum, every paving shift to allow adjustments to paving operations if measurements do not meet specification requirements. The Contractor must submit the survey data to the Engineer by the following day after measurements have been taken. The finished surface of the pavement shall not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm). The finished grade of each lot will be determined by running levels at intervals of 50 feet (15 m) or less longitudinally and all breaks in grade transversely (not to exceed 25 feet (7.5 m)) 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 registrered California 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 (m²). When more than 15% of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates 3/4 inch (19 mm) or more from planned grade, the Contractor shall remove the deficient area to the depth of the final course plus 1/2 inch (12 mm) of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off provided 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 (2 and 3.5 mm) wide. The peaks and ridges shall be approximately 1/32 inch (1 mm) higher than the bottom of the grooves. The pavement shall be left in a clean condition. The removal of all of the slurry resulting from 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 (12.5 m²). Areas in excess of 15 square yards (12.5 m²) will require removal and replacement of the pavement in accordance with the limitations noted above. The Contractor shall apply a surface treatment per P-608 to all areas that have been subject to grinding.

c. Percentage of material within specification limits (PWL). The 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.
<table>
<thead>
<tr>
<th>TEST PROPERTY</th>
<th>Specification Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
</tr>
<tr>
<td>Air Voids Total Mix (%)</td>
<td>2</td>
</tr>
<tr>
<td>Mat Density (%)</td>
<td>96.3</td>
</tr>
<tr>
<td>Joint Density (%)</td>
<td>93.3</td>
</tr>
</tbody>
</table>

d. Outliers. All individual tests for mat density and air voids shall be checked for outliers (test criterion) in accordance with ASTM E178, at a significance level of 5%. Outliers shall be discarded, and the PWL shall be determined using the remaining test values. 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% 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% 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% 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 E178, at a significance level of 5%.

401-5.4 Leveling course. Any course used for trueing and leveling shall meet the aggregate gradation in Table 3, paragraph 401-3.2. The trueing and leveling course shall meet the requirements of paragraph 401-3.2, 401-5.2b(1) for air voids, but shall not be subject to the density requirements of paragraph 401-5.2b(1) for mat density and 401-5.2b(3) for joint density. The leveling course shall be compacted with the same effort used to achieve density of the test section. The trueing and leveling course shall not exceed the maximum lift thickness associated with each gradation in Table 3, paragraph 401-3.2. 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 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
m. CV of the aggregate
n. Lift thickness
o. Grade
p. Rolling pattern
q. VMA

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 Quality Control Program.

401-6.2 Contractor testing laboratory. The lab shall meet the requirements of ASTM D3666 including all necessary equipment, materials, and current reference standards to comply with the specifications.

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.

a. Asphalt content. A minimum of two asphalt content tests shall be performed per lot in accordance with ASTM D6307 or ASTM D2172 if the correction factor in ASTM D6307 is greater than 1.0. The asphalt content for the lot will be determined by averaging the test results.

b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444, ASTM C136, and ASTM C117.
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 C566.

d. **Moisture content of HMA.** The moisture content shall be determined once per lot in accordance with ASTM D1461.

e. **Temperatures.** Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the HMA at the plant, and the HMA 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 D2950.

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 (that is, difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each sublot will be calculated and monitored by the Quality Control laboratory.

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, asphalt content, and VMA. 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

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Action Limit</th>
<th>Suspension Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch (19 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>1/2 inch (12 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>3/8 inch (9 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>±5%</td>
<td>±7.5%</td>
</tr>
<tr>
<td>No. 50 (0.30 mm)</td>
<td>±3%</td>
<td>±4.5%</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>±2%</td>
<td>±3%</td>
</tr>
<tr>
<td>Asphalt Content</td>
<td>±0.45%</td>
<td>±0.70%</td>
</tr>
<tr>
<td>VMA</td>
<td>-1.00%</td>
<td>-1.50%</td>
</tr>
</tbody>
</table>

### 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)

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Suspension Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 inch (12 mm)</td>
<td>11%</td>
</tr>
<tr>
<td>3/8 inch (9 mm)</td>
<td>11%</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>11%</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>9%</td>
</tr>
<tr>
<td>No. 50 (0.30 mm)</td>
<td>6%</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>3.5%</td>
</tr>
<tr>
<td>Asphalt Content</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

### 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.

### 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 100.
METHOD OF MEASUREMENT

401-7.1 Measurement. HMA shall be measured by the number of tons (kg) of HMA used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

BASIS OF PAYMENT

401-8.1 Payment. Payment for a lot of HMA meeting all acceptance criteria as specified in paragraph 401-5.2 shall be made based on results of tests for smoothness, mat density and air voids. Payment for acceptable lots shall be adjusted according to paragraph 401-8.1a for mat density and air voids and 401-8.1c for smoothness, subject to the limitation that:

a. The total project payment for plant mix bituminous concrete pavement shall not exceed 100 percent of the product of the contract unit price and the total number of tons (kg) of HMA used in the accepted work (See Note 1 under Table 6).

b. 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.

c. 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% 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% 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%. If PWL for joint density is less than 71 percent then the lot pay factor shall be reduced by 5% but be no higher than 95%.

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% for accepted lots of HMA shall be used to offset payment for accepted lots of bituminous concrete pavement that achieve a lot pay factor less than 100%.

Table 6. Price adjustment schedule

<table>
<thead>
<tr>
<th>Percentage of material within specification limits (PWL)</th>
<th>Lot pay factor (percent of contract unit price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>93 – 100</td>
<td>103</td>
</tr>
<tr>
<td>90 – 93</td>
<td>PWL + 10</td>
</tr>
<tr>
<td>70 – 89</td>
<td>0.125 PWL + 88.75</td>
</tr>
<tr>
<td>40 – 69</td>
<td>0.75 PWL + 45</td>
</tr>
<tr>
<td>Below 40</td>
<td>Reject 2</td>
</tr>
</tbody>
</table>

1 Although it is theoretically possible to achieve a pay factor of 103% for each lot, actual payment above 100% 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% of the contract unit price and the total project payment shall be reduced by the amount withheld for the rejected lot.
d. Profilograph smoothness. When the final average profile index (subsequent to any required corrective action) does not exceed 7 inches per mile (18 cm per 1.6 km), payment will be made at the contract unit price for the completed pavement. If the final average profile index (subsequent to any required corrective action) exceeds 7 inches per mile (18 cm per 1.6 km), but does not exceed 15 inches per mile (38 cm per 1.6 m), the Contractor may elect to accept a contract unit price adjustment in lieu of reducing the profile index.

e. Basis of adjusted payment for smoothness. Price adjustment for pavement smoothness will be made in accordance with Table 7. The adjustment will apply to the total tonnage of HMA within a lot of pavement and shall be applied with the following equation:

\[(\text{Tons of asphalt concrete in lot}) \times (\text{lot pay factor}) \times (\text{unit price per ton}) \times (\text{smoothness pay factor}) = \text{payment for lot}\]

Table 7. Profilograph Average Profile Index Smoothness Pay Factor

<table>
<thead>
<tr>
<th>Inches/miles per 1/10 mile</th>
<th>Short Sections</th>
<th>Pay Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 7</td>
<td>00.0 - 15.0</td>
<td>100%</td>
</tr>
<tr>
<td>7.1 - 9</td>
<td>15.1 - 16</td>
<td>98%</td>
</tr>
<tr>
<td>9.1 - 11</td>
<td>16.1 - 17</td>
<td>96%</td>
</tr>
<tr>
<td>11.1 - 13</td>
<td>17.1 - 18</td>
<td>94%</td>
</tr>
<tr>
<td>13.1 - 14</td>
<td>18.1 - 20</td>
<td>92%</td>
</tr>
<tr>
<td>14.1 - 15</td>
<td>20.1 - 22</td>
<td>90%</td>
</tr>
<tr>
<td>15.1 and up</td>
<td>22.1 and up</td>
<td>Corrective work required¹</td>
</tr>
</tbody>
</table>

¹ The Contractor shall correct pavement areas not meeting these tolerances by removing and replacing the defective work. If the Contractor elects to construct an overlay to correct deficiencies, the minimum thickness of the overlay should be at least three times the maximum aggregate size (approximately four (4) times the nominal maximum aggregate size). The corrective overlay shall not violate grade Criteria and butt joints shall be constructed by sawing and removing the original pavement in compliance with the thickness/ maximum aggregate size ratio. Skin patching shall not be permitted.

HMA placed above the specified grade shall not be included in the quantities for payment.

401-8.1.1. Payment. Payment will be made under:

Item P-401-8.1.1 Bituminous Surface Course - per ton (kg)

TESTING REQUIREMENTS

ASTM C29 Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate

ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C117 Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C127 Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
ASTM C136  Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C183  Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM C566  Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM D75   Standard Practice for Sampling Aggregates
ASTM D979  Standard Practice for Sampling Bituminous Paving Mixtures
ASTM D1073 Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D2172 Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D1461 Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D2041 Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2489 Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D2726 Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D2950 Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D3203 Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM D3665 Standard Practice for Random Sampling of Construction Materials
ASTM D3666 Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4791 Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867 Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5444 Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
ASTM D6307 Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
MATERIAL REQUIREMENTS

ASTM D946 Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D4552 Standard Practice for Classifying Hot-Mix Recycling Agents
ASTM D6373 Standard Specification for Performance Graded Asphalt Binder
Intentionally Left Blank
Item P-403 Hot Mix Asphalt (HMA) Pavements (Base, Leveling or Surface Course)

NOT USED

END OF ITEM P-403
Part 6 – Rigid Pavement

Item P-501 Portland Cement Concrete (PCC) Pavement

NOT USED

END ITEM P-501
Part 7 – Miscellaneous

Item P-601 Fuel-Resistant Hot Mix Asphalt (HMA) Pavement

NOT USED

END OF ITEM P-601
Intentionally Left Blank
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 bituminous material shall be an emulsified asphalt indicated in ASTM D3628 as a bituminous application for prime coat appropriate to local conditions or as designated by the Engineer.

CONSTRUCTION METHODS

602-3.1 Weather limitations. The prime coat shall be applied only when the existing surface is dry; the atmospheric temperature is 50°F (10°C) or above, and the temperature has not been below 35°F (2°C) for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the Engineer.

602-3.2 Equipment. The equipment shall include a self-powered pressure bituminous material distributor and equipment for heating bituminous material.

Provide a distributor with pneumatic tires of such size and number that the load produced on the base surface does not exceed 65.0 psi (4.5 kg/sq cm) of tire width to prevent rutting, shoving or otherwise damaging the base, surface or other layers in the pavement structure. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard (0.23 to 9.05 L/square meter), with a pressure range of 25 to 75 psi (172.4 to 517.1 kPa) and with an allowable variation from the specified rate of not more than ±5%, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. Equip the distributor to circulate and agitate the bituminous material during the heating process. If the distributor is not equipped with an operable quick shutoff valve, the prime 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 power blower suitable for cleaning the surfaces to which the bituminous coat is to be applied shall be provided.

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 shall be uniformly applied with a bituminous distributor at the rate of 0.15 to 0.30 gallons per square yard (0.68 to 1.36 liters per square meter) 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 application of the bituminous material and prior to application of the succeeding layer of pavement, allow the bituminous coat to cure and to obtain evaporation of any volatiles or moisture. Maintain the coated surface until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread enough sand to effectively blot up and cure excess bituminous material. Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

602-3.4 Trial applications. Before providing the complete bituminous coat, the Contractor shall apply three lengths of at least 100 feet (30 m) for the full width of the distributor bar to evaluate the amount of bituminous material that can be satisfactorily applied with the equipment. Apply three different trial application rates of bituminous materials within the application range specified in paragraph 602-3.3. Other trial applications will be made using various amounts of material as deemed necessary by the Engineer.

602-3.5 Bituminous material Contractor’s responsibility. The Contractor shall provide a statement of source and character of the proposed bituminous material which must be submitted to and approved by the Engineer before any shipment of bituminous materials to the project. 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 be provided to and approved by the Engineer before the bituminous material is applied. If the bituminous material does not meet the specifications, it shall be replaced at the Contractor’s expense. Furnishing the vendor’s certified test report for the bituminous material shall not be interpreted as basis for final acceptance.

602-3.6 Freight and weigh bills. The Contractor shall submit waybills and delivery tickets during the progress of the work. Before the final estimate is allowed, file with the Engineer certified waybills and certified delivery tickets for all bituminous materials used in the construction of the pavement covered by the contract. Do not remove bituminous material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

602-4.1 The bituminous material for prime coat shall be measured by the gallon (liter). Volume shall be corrected to the volume at 60°F (16°C) in accordance with ASTM D1250. The bituminous material paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10% over the specified application rate. Any amount of bituminous material more than 10% over the specified application rate for each application will be deducted from the measured quantities, except for irregular areas where hand spraying of the bituminous material is necessary. Water added to emulsified asphalt will not be measured for payment.

BASIS OF PAYMENT

602-5.1 Payment shall be made at the contract unit price per gallon (liter) for bituminous prime coat. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.
Payment will be made under:

Item P-602-5.1 Bituminous Prime Coat - per gallon (liter)

TESTING REQUIREMENTS


MATERIAL REQUIREMENTS

ASTM D977 Standard Specification for Emulsified Asphalt
ASTM D2028 Standard Specification for Cutback Asphalt (Rapid-Curing Type)
ASTM D2397 Standard Specification for Cationic Emulsified Asphalt
ASTM D3628 Standard Practice for Selection and Use of Emulsified Asphalts

END OF ITEM P-602
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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 an emulsified asphalt indicated in ASTM D3628 as a bituminous application for tack coat appropriate to local conditions or as designated by the Engineer.

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 50°F (10°C) or above; the temperature has not been below 35°F (2°C) for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the Engineer.

603-3.2 Equipment. The Contractor shall provide equipment for heating and applying the bituminous material.

Provide a distributor with pneumatic tires of such size and number that the load produced on the base surface does not exceed 65.0 psi (4.5 kg/sq cm) of tire width to prevent rutting, shoving or otherwise damaging the base, surface or other layers in the pavement structure. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard (0.23 to 9.05 L/square meter), with a pressure range of 25 to 75 psi (172.4 to 517.1 kPa) and with an allowable variation from the specified rate of not more than ±5%, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. Equip the distributor to circulate and agitate the bituminous material during the heating process. If the distributor is not equipped with an operable quick shutoff 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 power blower suitable for cleaning the surfaces to which the bituminous tack coat is to be applied shall be provided.

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 power blower 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 the overlying mixture is placed on the tacked surface.

The bituminous material including vehicle shall be uniformly applied with a bituminous distributor at the rate of 0.05 to 0.10 gallons per square yard (0.20 to 0.50 liters per square meter) 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.

After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of the tack coat. This period shall be determined by the Engineer. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed.

603-3.4 Bituminous material Contractor’s responsibility. The Contractor shall provide a statement of source and character of the proposed bituminous material which must be submitted and approved by the Engineer before any shipment of bituminous materials to the project.

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 be provided to and approved by the Engineer before the bituminous material is applied. If the bituminous material does not meet the specifications, it shall be replaced at the Contractor’s expense. Furnishing the vendor’s certified test report for the bituminous material shall not be interpreted as a basis for final acceptance.

603-3.5 Freight and weigh bills The Contractor shall submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the Engineer certified waybills and certified delivery tickets for all bituminous materials used in the construction of the pavement covered by the contract. Do not remove bituminous material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

603-4.1 The bituminous material for tack coat shall be measured by the gallon (liter). Volume shall be corrected to the volume at 60°F (16°C) in accordance with ASTM D1250. The bituminous material paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10% over the specified application rate. Any amount of bituminous material more than 10% over the specified application rate for each application will be deducted from the measured quantities, except for irregular areas where hand spraying of the bituminous material is necessary. Water added to emulsified asphalt will not be measured for payment.

BASIS OF PAYMENT

603.5-1 Payment shall be made at the contract unit price per gallon (liter) of bituminous material. This price shall be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-603-5.1 Bituminous Tack Coat - per gallon (liter)
MATERIAL REQUIREMENTS

ASTM D633  Standard Volume Correction Table for Road Tar
ASTM D977  Standard Specification for Emulsified Asphalt
ASTM D2028 Standard Specification for Cutback Asphalt (Rapid-Curing Type)
ASTM D2397 Standard Specification for Cationic Emulsified Asphalt
ASTM D3628 Standard Practice for Selection and Use of Emulsified Asphalts

END ITEM P-603
Intentionally Left Blank
Item P-604 Compression Joint Seals for Concrete Pavements

NOT USED

END ITEM P-604
Intentionally Left Blank
Item P-605 Joint Sealants for Concrete Pavements

NOT USED

END ITEM P-605
Intentionally Left Blank
**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.

********************************************************************************

**If the material is to be used on bituminous concrete pavements and it is not formulated for this use, cracking and separation of the material from sawed wireway kerfs and around light fixtures may occur.**

********************************************************************************

**EQUIPMENT AND MATERIALS**

**606-2.1 Curing.** When pre-warmed 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 D638.

**606-3.2 Expansion.** Tests for coefficients of linear and cubical expansion shall be conducted in accordance with ASTM D1168, Method B, except that mercury shall be used instead of glycerine. The test specimen shall be mixed in the proportions specified by the manufacturer, and cured in a glass tub approximately 2 inch (50 mm) long by 3/8 inch (9 mm) 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 one (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 D149 for sealing compounds to be furnished for sealing electrical wires in pavement.
### Table 1. Property Requirements

<table>
<thead>
<tr>
<th>Physical or Electrical Property</th>
<th>Minimum</th>
<th>Maximum</th>
<th>ASTM Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tensile</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland cement concrete</td>
<td>1,000 psi</td>
<td>(70 kg/sq cm)</td>
<td>D 638</td>
</tr>
<tr>
<td>Bituminous concrete</td>
<td>500 psi</td>
<td>(35 kg/sq cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Elongation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland cement concrete</td>
<td>See note ¹</td>
<td></td>
<td>D 638</td>
</tr>
<tr>
<td>Bituminous concrete</td>
<td>50%</td>
<td></td>
<td>D 638</td>
</tr>
<tr>
<td>Coef. of cub. exp. cu. cm/cu. cm/°C</td>
<td>0.00090</td>
<td>0.00120</td>
<td>D 1168</td>
</tr>
<tr>
<td>Coef. of lin. exp. cm/cm/°C</td>
<td>0.000030</td>
<td>0.000040</td>
<td>D 1168</td>
</tr>
<tr>
<td>Dielectric strength, short time test</td>
<td>350 volts/mil.</td>
<td></td>
<td>D 149</td>
</tr>
<tr>
<td>Arc resistance</td>
<td>125 sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pull-off</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesion to steel</td>
<td>1,000 psi</td>
<td>(70 kg/sq cm)</td>
<td></td>
</tr>
<tr>
<td>Adhesion to Portland cement concrete</td>
<td>200 psi</td>
<td>(14 kg/sq cm)</td>
<td></td>
</tr>
<tr>
<td>Adhesion to asphalt concrete</td>
<td>No test available.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesion to aluminum</td>
<td>250 psi</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ 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 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 inch) (25 mm by 25 mm by 150 mm) 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 (6 mm).

### 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 (21 liters) of water per bag of cement, a cement factor of 6, ±0.5, bags of cement per cubic yard (0.76 cubic meter) of concrete, and a slump of 2-1/2 inch (60 mm), ±1/2 inch (60 mm ±12 mm). The ratio of fine aggregate to total aggregate shall be approximately 40% by solid volume. The air content shall be 5.0%, ±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 one inch (25 mm) by 2 inch (75 mm) by 3 inch (25 mm by 50 mm by 75 mm) 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 C192.

Table 2. Aggregate For Bond Test Blocks

<table>
<thead>
<tr>
<th>Type</th>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Aggregate</td>
<td>3/4 inch (19 mm)</td>
<td>97 to 100</td>
</tr>
<tr>
<td></td>
<td>1/2 inch (12 mm)</td>
<td>63 to 69</td>
</tr>
<tr>
<td></td>
<td>3/8 inch (9 mm)</td>
<td>30 to 36</td>
</tr>
<tr>
<td></td>
<td>No. 4 (4.75 mm)</td>
<td>0 to 3</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>No. 4 (4.75 mm)</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>No. 8 (2.36 mm)</td>
<td>82 to 88</td>
</tr>
<tr>
<td></td>
<td>No. 16 (1.18 mm)</td>
<td>60 to 70</td>
</tr>
<tr>
<td></td>
<td>No. 30 (600 μm)</td>
<td>40 to 50</td>
</tr>
<tr>
<td></td>
<td>No. 50 (300 μm)</td>
<td>16 to 26</td>
</tr>
<tr>
<td></td>
<td>No. 100 (150 μm)</td>
<td>5 to 9</td>
</tr>
</tbody>
</table>

**b. Bond test.** Prior to use, oven-dry the test blocks to constant weight at a temperature of 220°F to 230°F (104°C to 110°C), cool to room temperature, 73.4°F ±3°F (23°C ±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 one inch by 3 inch (25 mm by 75 mm) 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 (6 mm).

**606-3.7 Compatibility with asphalt concrete.** Test for compatibility with asphalt in accordance with ASTM D5329.

**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 or bituminous concrete pavements. 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. When used with Item P-605, such as light can installation, Item P-605 shall not be applied until the Item P-606 has fully cured.
Installation methods such as surface preparation, mixing ratios, and pot life are as important to satisfactory performance as the properties of the material itself. Therefore, the Engineer may wish to require a manufacturer’s representative to be present during the initial installation of the material to ensure the installation procedures are in accordance with the manufacturer’s directions.

**METHOD OF MEASUREMENT**

**606-4.1** The adhesive compound shall be measured by the [pound (kg)] [gallon (l)] of adhesive as specified, in place, complete and accepted. When required in the installation of an in-runway lighting system or portion thereof, no measurement will be made for direct payment of adhesive, as the cost of furnishing and installing shall be considered as a subsidiary obligation in the completion of the installation.

**BASIS OF PAYMENT**

**606-5.1** Payment shall be made, where applicable, at the contract unit price per [pound (kg)] [gallon (l)] for the adhesive. This price shall be full compensation for furnishing all materials, and for all preparation, delivering, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Item P-606-5.1 Adhesive Compound - per [pound (kg)] [gallon (l)]

**TESTING REQUIREMENTS**

- ASTM C192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
- ASTM D149 Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- ASTM D1168 Standard Test Method for Hydrocarbon Waxes Used for Electrical Insulation
- ASTM D5329 Standard Test Methods for Sealants and Fillers, Hot-applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements

**END OF ITEM P-606**
Item P-608 Emulsified Asphalt Seal Coat

NOT USED

END OF ITEM P-608
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Item P-609 Bituminous Surface Treatments

NOT USED

END OF ITEM P-609
Item P-610 Structural Portland Cement Concrete

DESCRIPTION

610-1.1 This item shall consist of plain and reinforced structural portland cement concrete (PCC), prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans. This specification shall be used for all structural and miscellaneous concrete including signage bases.

MATERIALS

610-2.1 General. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. Materials may be subject to inspection and tests at any time during their preparation or use. The source of all materials shall be approved by the Engineer before delivery or use in the work. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to ensure 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 in them.

The use of pit-run aggregates shall not be permitted unless the pit-run aggregate has been screened and washed, and all fine and coarse aggregates stored separately and kept clean. The mixing of different aggregates from different sources in one storage stockpile or alternating batches of different aggregates shall not be permitted.

a. Reactivity. Fine and Coarse aggregates to be used in all concrete shall be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and C1567. Aggregate and mix proportion reactivity tests shall be performed for each project.

   (1) Coarse and fine aggregate shall be tested separately in accordance with ASTM C1260. The aggregate shall be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.10% at 28 days (30 days from casting).

   (2) Combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) CRD C662. If lithium nitrate admixture is used, it shall be nominal 30% ±0.5% weight lithium nitrate in water.

   (3) If the expansion of the proposed combined materials test specimens, tested in accordance with ASTM C1567, modified for combined aggregates, or COE CRD C662, does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion of the proposed combined materials test specimens is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.
**610-2.2 Coarse aggregate.** The coarse aggregate for concrete shall meet the requirements of ASTM C33. Crushed stone aggregate shall have a durability factor, as determined by ASTM C666, 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 the following gradation shown in the table below when tested per ASTM C136.

<table>
<thead>
<tr>
<th>Sieve Designation (square openings)</th>
<th>Percentage by Weight Passing Sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4 to 3/4 in. (4.75-19 mm)</td>
<td>--</td>
</tr>
<tr>
<td>No. 4 to 1 in. (4.75-25 mm)</td>
<td>100</td>
</tr>
<tr>
<td>No. 4 to 1-1/2 in. (4.75-38 mm)</td>
<td>95-100</td>
</tr>
</tbody>
</table>

**610-2.2.1 Aggregate susceptibility to durability (D) cracking.** Aggregates that have a history of D-cracking shall not be used.

Coarse aggregate may be accepted from sources that have a 20 year service history for the same gradation to be supplied with no durability issues.

a. Material currently being produced shall have a durability factor \( \geq 95 \) using ASTM C666. Coarse aggregates that are crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite or trap rock are considered to meet the D-cracking test but must meet all other quality tests. Aggregates meeting State Highway Department material specifications may be acceptable with concurrence of the FAA.

b. The Contractor shall submit a current certification that the aggregate does not have a history of D-cracking and that the aggregate meets the state specifications for use in PCC pavement for use on interstate highways. Certifications, tests and any history reports must be for the same gradation as being proposed for use on the project. Certifications which are not dated or which are over one (1) year old or which are for different gradations will not be accepted. Test results will only be accepted when tests were performed by a California Department of Transportation (Caltrans) materials laboratory or an accredited laboratory.

**610-2.3 Fine aggregate.** The fine aggregate for concrete shall meet the requirements of ASTM C33.

The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of the table below when tested in accordance with ASTM C136:

<table>
<thead>
<tr>
<th>Sieve Designation (square openings)</th>
<th>Percentage by Weight Passing Sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch (9 mm)</td>
<td>100</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>95-100</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>45-80</td>
</tr>
<tr>
<td>No. 30 (0.60 mm)</td>
<td>25-55</td>
</tr>
<tr>
<td>Sieve Designation (square openings)</td>
<td>Percentage by Weight Passing Sieves</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>No. 50 (0.30 mm)</td>
<td>10-30</td>
</tr>
<tr>
<td>No. 100 (0.15 mm)</td>
<td>2-10</td>
</tr>
</tbody>
</table>

Blending will be permitted, if necessary, 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, if the deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than Portland cement, as specified in paragraph 610-2.6, 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.

If aggregates are deemed innocuous when tested in accordance with paragraph 610-2.1.a.1 and accepted in accordance with paragraph 610-2.1.a.3, higher equivalent alkali content in the cement may be allowed if approved by the Engineer and FAA. If 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.

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 use of the cement is granted. All 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 fresh, clean and potable; free from injurious amounts of oils, acids, alkalies, salts, organic materials or other substances deleterious to concrete.

610-2.6 Admixtures. 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 C260 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. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D. ASTM C494, Type F and G high range water reducing admixtures and ASTM C1017 flowable admixtures shall not be used.

c. Other chemical admixtures. The use of set retarding, and set-accelerating admixtures shall be approved by the Engineer. Retarding shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

610-2.7 Premolded joint material. Premolded joint material for expansion joints shall meet the requirements of ASTM D1751.

610-2.8 Joint filler. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified.

610-2.9 Steel reinforcement. Reinforcing shall consist of Reinforcing Steel conforming to the requirements of ASTM A615, ASTM A706, ASTM A775, ASTM A934. Welded Steel Wire Fabric shall conforming to the requirements of ASTM A1064.
Membrane-Forming Compound, Type 2, Class B per ASTM C309.

The Engineer shall select one or more of the following:

<table>
<thead>
<tr>
<th>Material</th>
<th>ASTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterproof paper</td>
<td>C171</td>
</tr>
<tr>
<td>Clear or white Polyethylene Sheeting</td>
<td>C171</td>
</tr>
<tr>
<td>White-pigmented Liquid Membrane-Forming Compound, Type 2, Class B</td>
<td>C309</td>
</tr>
</tbody>
</table>

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 here. All machinery and equipment used by the Contractor on the work, shall be of sufficient size to meet the requirements of the work. All work shall be subject to the inspection and approval of the Engineer.

610-3.2 Concrete composition. The concrete shall develop a compressive strength of 4,000 psi in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cement per cubic yard (280 kg per cubic meter). The concrete shall contain 5% of entrained air, ±1%, as determined by ASTM C231 and shall have a slump of not more than 4 inches (100 mm) as determined by ASTM C143.

610-3.3 Acceptance sampling and testing. Concrete for each structure will be accepted on the basis of the compressive strength specified in paragraph 610-3.2. The concrete shall be sampled in accordance with ASTM C172. Concrete cylindrical compressive strength specimens shall be made by the contractor’s quality control lab in accordance with ASTM C31 and tested in accordance with ASTM C39. The Contractor shall cure and store the test specimens under such conditions as directed by the Engineer. The Engineer will make the actual tests on the specimens at no expense to the Contractor.

610-3.4 Qualifications for concrete testing service. The Contractor’s quality control concrete testing laboratory shall be an approved laboratory and inspection service experienced in sampling and testing concrete. Testing agency must meet the requirements of ASTM C1077 or ASTM E329.

610-3.5 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 the required, exact weight of aggregates is obtained.

610-3.6 Consistency. The consistency of the concrete shall be determined by the slump test specified in ASTM C143.

610-3.7 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 C94.

610-3.8 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 expense.

Retempering of concrete by adding water or any other material shall not be permitted.

The rate of delivery of concrete to the job shall be sufficient to allow uninterrupted placement of the concrete.

**610-3.9 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 shown 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 surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes. The Contractor shall be responsible for their adequacy.

The internal form ties shall be arranged so no metal will show in the concrete surface or discolor the surface when exposed to weathering when the forms are removed. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied immediately before the concrete is placed. Forms shall be constructed so they can be removed without injuring the concrete or concrete surface. The forms shall not be removed until at least 30 hours after concrete placement for 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 the concrete has developed at least 60% of the design strength.

**610-3.10 Placing reinforcement.** All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concrete placement. 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.

**610-3.11 Embedded items.** Before placing concrete, all embedded items shall be firmly and securely fastened in place as indicated. All embedded items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The concrete shall be spaded and consolidated around and against embedded items. The embedding of wood shall not be allowed.

**610-3.12 Placing concrete.** All concrete shall be placed during daylight hours, unless otherwise approved. The concrete shall not be placed until the depth and condition of foundations, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the Engineer. Concrete shall be placed as soon as practical after mixing, but in no case later than one (1) hour after water has been added to the mix. The method and manner of placing shall avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. The concrete shall not be dropped from a height of more than 5 feet (1.5 m). Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation. Concrete shall be placed on clean, damp surfaces, free from running water, or on a properly consolidated soil foundation.

**610-3.13 Vibration.** Vibration shall follow the guidelines in American Concrete Institute (ACI) Committee 309, Guide for Consolidation of Concrete. Where bars meeting ASTM A775 or A934 are used, the vibrators shall be equipped with rubber or non-metallic vibrator heads. Furnish a spare, working, vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches (100 mm) in depth with high frequency mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches (100 mm) or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate internal vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 cycles per minute when submerged. Do not use vibrators to transport the concrete in the forms. Penetrate the previously placed lift with the vibrator when more than one lift is required. Use external vibrators on the exterior surface of the forms.
when internal vibrators do not provide adequate consolidation of the concrete. Vibrators shall be manipulated to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any point shall be of sufficient duration to accomplish compaction but shall not be prolonged to where segregation occurs. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie or other approved method and shall not be disturbed after placement.

610-3.14 Construction joints. If the placement 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, provisions shall be made for grooves, steps, reinforcing bars or other devices as specified. 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.

610-3.15 Expansion joints. Expansion joints shall be constructed at such points and dimensions as indicated on the drawings. The premolded filler shall be cut to the same shape as the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place so that it will not be displaced when concrete is deposited against it.

610-3.16 Defective work. Any defective work discovered after the forms have been removed, which in the opinion of the Engineer cannot be repaired satisfactorily, shall be immediately removed and replaced at the expense of the Contractor. Defective work shall include deficient dimensions, or bulged, uneven, or honeycomb on the surface of the concrete.

610-3.17 Surface finish. All exposed concrete surfaces shall be true, smooth, and free from open or rough areas, depressions, or projections. All concrete horizontal plane surfaces shall be brought flush to the proper elevation with the finished top surface 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.

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 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 finishing machine.

610-3.18 Curing and protection. All concrete shall be properly cured and protected by the Contractor. The concrete shall be protected from the weather, flowing water, and from defacement of any nature during the project. The concrete shall be cured by covering with an approved material as soon as it has sufficiently hardened. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for at least three (3) days following concrete placement. 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 air currents. Wooden forms shall be kept wet at all times until removed to prevent opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for seven (7) days after the concrete has been placed.

610-3.19 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.

610-3.20 Cold weather placing. 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 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 pounds (908 grams) of Type 1 nor more than 1.6 pounds (726 grams) 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.

610-3.21 Hot weather placing. Concrete shall be properly placed and finished with procedures previously submitted. The concrete-placing temperature shall not exceed 90°F (32°C) when measured in accordance with ASTM C1064. Cooling of the mixing water and aggregates, or both, may be required to obtain an adequate placing temperature. A retarder meeting the requirements of paragraph 610-2.6 may be used to facilitate placing and finishing. Steel forms and reinforcement shall be cooled prior to concrete placement when steel temperatures are greater than 120°F (50°C). Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature. Submit the proposed materials and methods for review and approval by the Engineer, if concrete is to be placed under hot weather conditions.

610-3.22 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 start until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be done with proper equipment to obtain a neat looking joint free from excess filler.

**METHOD OF MEASUREMENT**

610-4.1 Portland cement concrete shall be measured by the number of cubic yards (cubic meters) of concrete complete in place and accepted. In computing the yardage of concrete for payment, the dimensions used shall be those shown on the plans or ordered by the Engineer. No measurements or other allowances shall be made for forms, falsework, cofferdams, pumping, bracing, expansion joints, or finishing of the concrete. No deductions in yardage shall be made for the volumes of reinforcing steel or embedded items.

610-4.2 Reinforcing steel shall be not be measured or paid for separately, it shall be considered subsidiary obligation of the contractor covered under the Structural Portland Cement Concrete contract item.

**BASIS OF PAYMENT**

610-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for structural Portland cement concrete. This price shall be full compensation for furnishing all materials and for all preparation, delivery and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-610-5.1 Structural Portland Cement Concrete, per cubic yard (cubic meter)

**TESTING REQUIREMENTS**

<table>
<thead>
<tr>
<th>Standard Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C31</td>
<td>Standard Practice for Making and Curing Concrete Test Specimens in the Field</td>
</tr>
<tr>
<td>ASTM C39</td>
<td>Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens</td>
</tr>
</tbody>
</table>
ASTM C136 Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C1017 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064 Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

U.S. Army Corps of Engineers (USACE) Concrete Research Division (CRD) C662 Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

MATERIAL REQUIREMENTS

ASTM A184 Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704 Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A934 Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C33 Standard Specification for Concrete Aggregates
ASTM C94 Standard Specification for Ready-Mixed Concrete
ASTM C150 Standard Specification for Portland Cement
ASTM C171 Standard Specification for Sheet Materials for Curing Concrete
ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete
ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494 Standard Specification for Chemical Admixtures for Concrete
ASTM C595 Standard Specification for Blended Hydraulic Cements
ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)
ASTM D1752 Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ACI 305R Hot Weather Concreting
ACI 306R Cold Weather Concreting
ACI 309R Guide for Consolidation of Concrete

END OF ITEM P-610
Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and 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. The terms “paint” and “marking material” as well as “painting” and “application of markings” are interchangeable throughout this specification.

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. All material shall arrive in sealed containers 55 gallons or smaller for inspection by the Engineer. Material shall not be loaded into the equipment until inspected by the Engineer.

620-2.2 Marking materials. Paint shall be waterborne in accordance with the requirements of paragraph 620-2.2. Paint shall be furnished in White – 37925, Red – 31136, Yellow – 33538 or 33655, and Black – 37038 in accordance with Federal Standard No. 595.

a. Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952E, Type II. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

620-2.3 Reflective media. Glass beads shall meet the requirements for 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.

<table>
<thead>
<tr>
<th>Paint Color</th>
<th>Glass Beads, Type I, Gradation A</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>See Table 1</td>
</tr>
<tr>
<td>Yellow</td>
<td>See Table 1</td>
</tr>
<tr>
<td>Red</td>
<td>See Table 1 and Note</td>
</tr>
<tr>
<td>Black</td>
<td>Not used</td>
</tr>
</tbody>
</table>
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 (7°C) and rising and the pavement surface temperature is at least 5°F (2.7°C) above the dew point or meets the manufacturer’s recommendations. Markings shall not be applied when the pavement temperature is greater than 130°F (55°C). Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns.

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 waterblasting to remove all contaminants without damage to the pavement surface. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the Engineer. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

At least 24 hours prior to remarking existing markings, and when shown on the Plans, the existing markings must be removed such that 75% of the existing markings are removed with low (3,500-10,000 psi) waterblaster. After waterblasting, the surface shall be cleaned of all residue or debris either with sweeping or blowing with compressed air or both.

Prior to the initial application of markings, the Contractor shall certify in writing that the surface has been prepared in accordance with the paint manufacturer’s requirements, that the application equipment is appropriate for the type of marking paint and that environmental conditions are appropriate for the material being applied. This certification along with a copy of the paint manufacturer’s surface preparation and application requirements must be submitted and approved by the Engineer prior to the initial application of markings.

620-3.4 Layout of markings. The proposed markings shall be laid out in advance of the paint application. All pavement markings except temporary markings and black paint, are to receive glass beads.

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 (12 mm) in 50 feet (15 m), and marking dimensions and spacings shall be within the following tolerances:

<table>
<thead>
<tr>
<th>Dimension and Spacing</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 inch (910 mm) or less</td>
<td>±1/2 inch (12 mm)</td>
</tr>
<tr>
<td>greater than 36 inch to 6 feet (910 mm to 1.85 m)</td>
<td>±1 inch (25 mm)</td>
</tr>
<tr>
<td>greater than 6 feet to 60 feet (1.85 m to 18.3 m)</td>
<td>±2 inch (50 mm)</td>
</tr>
<tr>
<td>greater than 60 feet (18.3 m)</td>
<td>±3 inch (76 mm)</td>
</tr>
</tbody>
</table>
The paint shall be mixed in accordance with the manufacturer’s instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted. A period of **30 calendar days (cure period)** shall elapse between placement of a bituminous surface course or seal coat and full application of the paint.

The existing runway is required to be temporarily shortened and relocated to facilitate the construction. In addition, the new pavements are desired to be opened to aircraft traffic prior to the required cure time has elapsed. Accordingly, temporary markings will be required before paving operations are complete or to relocate the existing runway. The temporary paint shall be applied to the bituminous pavement as soon as practical but only after the pavement has cooled enough to accept the paint and the application of the paint will not damage the surface. Application rate for all temporary and phasing markings shall be at 50% of the application rate prescribed in Table 1. Glass beads shall not be applied to temporary or phasing markings. The final marking application must be at the full application rate in order to adequately set the glass bead; a 50% first application rate followed by a 50% second application rate will not be permitted.

Prior to the initial application of markings, the Contractor shall certify in writing that the surface has been prepared in accordance with the paint manufacturer’s requirements, that the application equipment is appropriate for the marking paint and that environmental conditions are appropriate for the material being applied. This certification along with a copy of the paint manufacturers application and surface preparation requirements must be submitted to the Engineer prior to the initial application of markings.

**620-3.6 Test strip.** Prior to the full application of airfield markings, the Contractor shall produce a test strip in the presence of the Engineer. The test strip shall include the application of a minimum of 5 gallons (4 liters) of paint and application of 35 lbs (15.9 kg) of Type I/50 lbs (22.7 kg) of Type III glass beads. The test strip shall be used to establish thickness/darkness standard for all markings. The test strip shall cover no more than the maximum area prescribed in Table 1 (e.g., for 5 gallons (19 liters) of waterborne paint shall cover no more than 575 square feet (53.4 m²)).

**Table 1. Application Rates For Paint And Glass Beads**

<table>
<thead>
<tr>
<th>Paint Type</th>
<th>Paint Square feet per gallon, ft²/gal (Sq m per liter, m²/l)</th>
<th>Glass Beads, Type I, Gradation A Pounds per gallon of paint-lb/gal (Km per liter of paint-kg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterborne Type I or II</td>
<td>115 ft²/gal max (2.8 m²/l)</td>
<td>7 lb/gal min (0.85 kg/l)</td>
</tr>
</tbody>
</table>

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 shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment should be performed.

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.

**620-3.7 Application--preformed thermoplastic 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 (5 m) and a free span between supporting wheels of no less than 18 feet (5.5 m). The heater must emit thermal radiation to the marking material in such a manner that the difference in temperature of 2 inches (50 mm) wide linear segments in the direction of heater travel must be within 5% 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 35°F (2°C) 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-volatile organic content (non-VOC) sealer with a maximum applied viscosity of 250 centiPoise must be applied to the pavement shortly before the markings are applied. The supplier must enclose application instructions with each box/package.

620-3.8 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 The quantity of runway and taxiway markings to be paid for shall be the number of square feet (square meters) of painting performed in accordance with the specifications and accepted by the Engineer. No separate measurement or payment shall be made for the glass beads, they shall be considered a subsidiary obligation of the contractor covered under this contract item.

620-4.2 Payment for temporary markings shall be the number of square feet of waterborne painting performed in accordance with the specifications and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

BASIS OF PAYMENT

620-5.1 Payment shall be made at the respective contract price per square foot (square meter) for runway and taxiway painting. This price shall be full compensation for furnishing all materials including reflective media, and for all labor, equipment, tools, and incidentals necessary to complete the item. Payment will be made under:

Item P-620-5.1-1 Runway and Taxiway Marking per square foot (square meter)
Item P-620-5.1-2 Temporary Marking per square foot (square meter)

TESTING REQUIREMENTS

ASTM C371 Standard Test Method for Wire-Cloth Sieve Analysis of Nonplastic Ceramic Powders
ASTM D92 Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester

Item P-620 Runway and Taxiway Marking
ASTM D1652  Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2074  Standard Test Method for Total, Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
ASTM D2240  Standard Test Method for Rubber Property - Durometer Hardness
ASTM D7585  Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments
ASTM G154  Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

**MATERIAL REQUIREMENTS**

ASTM D476  Standard Classification for Dry Pigmentary Titanium Dioxide Products
40 CFR Part 60, Appendix A-7, Method 24  Determination of volatile matter content, water content, density, volume solids, and weight solids of surface coatings
FED SPEC TT-B-1325D  Beads (Glass Spheres) Retro-Reflective
American Association of State Highway and Transportation Officials (AASHTO) M247  Standard Specification for Glass Beads Used in Pavement Markings
FED SPEC TT-P-1952E  Paint, Traffic and Airfield Marking, Waterborne
Commercial Item Description A-A-2886B  Paint, Traffic, Solvent Based
FED STD 595  Colors used in Government Procurement
AC 150/5340-1  Standards for Airport Markings

**END OF ITEM P-620**
Item P-621 Saw-Cut Grooves

NOT USED

END OF ITEM P-621
Intentionally Left Blank
Item P-626 Emulsified Asphalt Slurry Seal Surface Treatment

NOT USED

END OF ITEM P-626
Intentionally Left Blank
Item P-629 Thermoplastic Coal Tar Emulsion Surface Treatments

NOT USED

END OF ITEM P-629
Intentionally Left Blank
Item P-630 Refined Coal Tar Emulsion Without Additives, Slurry Seal Surface Treatment

NOT USED

END OF ITEM P-630
Item P-631 Refined Coal Tar Emulsion With Additives, Slurry Seal Surface Treatment

NOT USED

END OF ITEM P-631
Item P-632 Bituminous Pavement Rejuvenation

NOT USED

END OF ITEM P-632
Part 8 – Fencing

Item F-160 Wire Fence With Wood Posts (Class A and B Fences)

NOT USED

END OF ITEM F-160
Item F-160 Wire Fence With Wood Posts (Class A and B Fences)
Item F-161 Wire Fence With Steel Posts (Class C and D Fence)

NOT USED

END OF ITEM F-161
Intentionally Left Blank
Item F-162 Chain-Link Fence

NOT USED

END OF ITEM F-162
Intentionally Left Blank
Item F-163 Wildlife Deterrent Fence Skirt

NOT USED

END OF ITEM F-163
Intentionally Left Blank
Item F-164 Wildlife Exclusion Fence

NOT USED

END OF ITEM F-164
Intentionally Left Blank
Part 9 – Drainage

Item D-701 Pipe for Storm Drains and Culverts

NOT USED

END ITEM D-701
Item D-702 Slotted Drains

NOT USED

END OF ITEM D-702
Intentionally Left Blank
Item D-705 Pipe Underdrains for Airports

NOT USED

END OF ITEM D-705
Intentionally Left Blank
Item D-751 Manholes, Catch Basins, Inlets and Inspection Holes

NOT USED

END OF ITEM D-751
Item D-752 Concrete Culverts, Headwalls, and Miscellaneous Drainage Structures

NOT USED

END OF ITEM D-752
Intentionally Left Blank
Item D-754 Concrete Gutters, Ditches, and Flumes

NOT USED

END OF ITEM D-754
Part 10 – Turfing

Item T-901 Seeding

NOT USED

END OF ITEM T-901
Item T-903 Sprigging

NOT USED

END OF ITEM T-903
Item T-904 Sodding

NOT USED

END OF ITEM T-904
Intentionally Left Blank
Item T-905 Topsoiling

NOT USED

END OF ITEM T-905
Item T-908 Mulching

NOT USED

END OF ITEM T-908
Intentionally Left Blank
New Item T-910 Landscaping

DESCRIPTION

910-1.1 GENERAL This work shall consist of performing hydro-seeding, and other work necessary for stabilizing of the areas shown on the plans or as directed by the Engineer in accordance with these specifications.

This work shall consist of furnishing and applying erosion control materials, including preparing areas to receive erosion control materials, placing topsoil, applying and incorporating straw and applying fertilizer, seed, fiber, stabilizing emulsion and other materials to the areas shown on the plans, and as specified in these specifications.

910-1.2 Materials. Materials shall conform to the provisions in Section 910-1.3.

910-1.3 PREPARATION Preparation shall include all the work required to make ready the areas for application of erosion control materials. Loose rocks larger than 2-1/2 inches in maximum dimension and debris shall be removed and disposed of outside the Airport property unless otherwise permitted by the Engineer.

910-1.3 Seeding and Fertilizing. Seeding and fertilizing shall conform to the following provisions.

a) General Seed and commercial fertilizer shall be uniformly spread over the area at the rates specified in Table 1. Unless otherwise directed by the Engineer, seed shall be either applied with hydro-seeding equipment. A minimum of 525 pounds of fiber per acre with 200 pounds of fertilizer per acre shall be mixed and applied with the seed, and applied in the hydro-seeding operation. The fiber shall be furnished and applied at the Contractor's expense and shall be in addition to incorporating straw when an application or applications of straw are specified. The application rate for pellet-inoculated seed shall be determined using the seed weight exclusive of inoculant materials.

<table>
<thead>
<tr>
<th>Table 1</th>
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<tbody>
<tr>
<td>Material</td>
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<tr>
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</tr>
<tr>
<td>Seed – Common Bermuda</td>
</tr>
<tr>
<td>Fiber</td>
</tr>
<tr>
<td>Soil binder (starch)</td>
</tr>
<tr>
<td>Fertilizer (to be determined by soil test)</td>
</tr>
</tbody>
</table>
b) HYDRO-SEEDING Hydro-seeding shall consist of mixing and applying seed, commercial fertilizer, stabilizing emulsion and other materials, or any combination thereof, with fiber and water. The materials and the quantities thereof to be mixed with water will be specified in the special provisions. The quantity of water shall be as needed for application, except that when stabilizing emulsion is specified, the ratio of total water to total stabilizing emulsion in the mixture shall be as recommended by the manufacturer of the emulsion.

Mixing of materials for application with hydro-seeding equipment shall be performed in a tank with a built-in continuous agitation system of sufficient operating capacity to produce a homogeneous mixture and a discharge system which will apply the mixture at a continuous and uniform rate. The tank shall have a minimum capacity of 1,000 gallons. The Engineer may authorize use of equipment of smaller capacity if it is demonstrated that the equipment is capable of performing all operations satisfactorily.

A dispersing agent may be added to the mixture provided the Contractor furnishes evidence that the additive is not harmful. Any material considered harmful, as determined by the Engineer, shall not be used.

Any mixture containing stabilizing emulsion shall not be applied during rainy weather or when soil temperatures are below 40° F. Pedestrians or equipment shall not be permitted to enter areas where mixtures containing stabilizing emulsion have been applied.

Hydro-seeding must be applied prior to October 15th to promote germination of the seeds before heavy rains.

910-1.4 SOIL TESTING. This work consists of containing a soils nutrient test in the area to be hydroseeded. A soil sample of this area shall be sent to a qualified soils testing firm. The fertilizer to be used in the hydroseed mix will be determined by this soils test. All cost for the soil testing shall be at the Contractor’s sole cost.

MEASUREMENT

910-2.1 MEASUREMENT Quantities of erosion control hydro-seeding as shown by the limits on the plans or as ordered by the Engineer shall be measured per square yard.

PAYMENT

910-3.1 PAYMENT The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all erosion control work, complete in place, including applying water, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

Payment will be made under:

Item T-910-3.1 Hydro-seeding — per square yard

END OF ITEM T-910
Part 11 – Lighting Installation

Item L-101 Airport Rotating Beacons

NOT USED

END OF ITEM L-101
Intentionally Left Blank
Item L-103 Airport Beacon Towers

NOT USED

END OF ITEM L-103
Intentionally Left Blank
Item L-107 Airport Wind Cones

NOT USED

END OF ITEM L-107
Intentionally Left Blank
Item L-108 Underground Power Cable for Airports

DESCRIPTION

108-1.1 This item shall consist of furnishing and installing power cables that are direct buried and furnishing and/or installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. It includes excavation and backfill of trench for direct-buried cables only. 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 cable for FAA owned/operated facilities. Requirements and payment for trenching and backfilling for the installation of underground conduit and duct banks is in Item L-110, Airport Underground Electrical Duct Banks and Conduits.

EQUIPMENT AND MATERIALS

108-2.1 General.

a. Airport lighting equipment and materials covered by advisory circulars (AC) shall be approved under the Airport Lighting Equipment Certification Program per AC 150/5345-53, current version.

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 responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications at the Contractor’s cost.

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 products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue 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 that do not meet the system design and the standards and codes, specified in this document.
f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least [twelve (12) months] from the date of 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 a minimum insulation resistance per AC 150/5340-26B, Maintenance Airport Visual aid Facilities, Table 5-1 and paragraph 5.1.3.1, with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period.

The Engineer should specify the form in which submittals are to be received and number of copies.

The length of time for guarantee of materials and workmanship should be as stated in the contract between the Owner and Contractor and the contract special provisions.

Only Third Party certified manufacturers, listed in AC 150/5345-53, Appendix 3 Addendum (as required) and meeting the BUY AMERICAN preference requirements can provide equipment and materials specified in the Contract Documents. Documentation certifying compliance with the BUY AMERICAN preference rules for Airport Improvement Program (AIP) cited in 49 USC §50101 shall be included with each equipment and material submittal.

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 latest edition. Conductors for use on 6.6 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #8 American wire gauge AWG, L-824 [Type B, Type C], 5,000 volts, nonshielded, with [ethylene propylene insulation, cross-linked polyethylene insulation]. Conductors for use on 20 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #6 AWG, L-824 [Type B, Type C], 5,000 volts, nonshielded, with [ethylene propylene insulation, cross-linked polyethylene insulation]. L-824 conductors for use on the L-830 secondary of airfield lighting series circuits shall be sized in accordance with the manufacturer’s recommendations. All other conductors shall comply with FAA and National Electric Code (NEC) requirements. 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, 75°C. Conductors for parallel (voltage) circuits shall be sized and installed in accordance with NFPA-70, National Electrical Code.

Unless noted otherwise, all 600-volt and less non-airfield lighting conductor sizes are based on a 75°C, THWN-2, 600 volt insulation, copper conductors, not more than three single insulated conductors, in raceway, in free air. The conduit/duct sizes are based on the use of THWN-2, 600 volt insulated conductors. The Contractor shall make the necessary increase in conduit/duct sizes for other types of wire insulation. In no case shall the conduit/duct size be reduced. The minimum power circuit wire size shall be #12 AWG.

Conductor sizes may have been adjusted due to voltage drop or other engineering considerations. Equipment provided by the Contractor shall be capable of accepting the quantity and sizes of conductors shown in the Contract Documents. All conductors, pigtails, cable step-down adapters, cable step-up
adapters, terminal blocks and splicing materials necessary to complete the cable termination/splice shall be considered incidental to the respective pay items provided.

Cable type, size, number of conductors, strand and service voltage shall be as specified in the Contract Document.

108-2.3 Bare copper wire (counterpoise, bare copper wire ground and ground rods). Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare solid copper wire for counterpoise and/or No. 6 AWG insulated stranded for ground wire per ASTM B3 and ASTM B8, and shall be [bare copper wire][tinned copper] per ASTM B33. See AC 150/5340-30 for additional details about counterpoise and ground wire types and installation. For voltage powered circuits, the equipment ground conductor shall be minimum No. 6 AWG, 600V rated, Type XHHW insulated, green color, stranded copper equipment ground conductor.

Ground rods shall be [solid stainless steel][copper][copper-clad steel]. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than [8 feet (2.4 m)][10 feet (2.54 m)] long and [5/8 inch (16 mm)][3/4 inch (19 mm)] in diameter.

The Engineer should evaluate the soils in the vicinity of proposed counterpoise and ground rod installations and determine if soil conditions would adversely affect copper. The Engineer shall specify the type of ground rod and counterpoise wire to be installed in consideration of the soil conditions. If tinned copper counterpoise or ground wire is specified, include requirement for UL listing.

108-2.4 Cable connections. In-line connections or splices of underground primary cables shall be of the type called for on the plans, and shall be one of the types listed below. 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 3MTM Company, “Scotchcast” Kit No. 82-B, or as manufactured by Hysol® Corporation, “Hyseal Epoxy Splice” Kit No. E1135, or an approved equivalent, used for potting the splice is acceptable.

b. 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.

c. The factory-molded plug-in splice. Specification for L-823 Connectors, Factory-Molded to Individual Conductors, is acceptable.

b. The taped or heat-shrink 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 D4388 and the plastic tape should comply with Military Specification MIL-I-24391 or Commercial Item Description 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 that are designed for the application. Heat
shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.

In all the above cases, connections of cable conductors shall be made using crimp connectors using 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 per the manufacturer’s recommendations and listings.

All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved equivalent, except that a light base ground clamp connector shall be used for attachment to the light base. See AC 150/5340-30 for additional information about methods of attaching a ground to a galvanized light base. All exothermic connections shall be made per the manufacturer’s recommendations and listings.

108-2.5 Splicer qualifications. Every airfield lighting cable splicer shall be qualified in making airport cable splices and terminations on cables rated at or above 5,000 volts AC. The Contractor shall submit to the Engineer proof of the qualifications of each proposed cable splicer for the airport cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

108-2.6 Concrete. Concrete for cable markers shall be per 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 be 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.

108-2.9 Tape. Electrical tapes shall be Scotch™ Electrical Tapes –Scotch™ 88 (1-1/2 inch (38 mm) wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch (50 mm) wide), as manufactured by the Minnesota Mining and Manufacturing Company (3M™), or an approved equivalent.

108-2.10 Electrical coating. Electrical coating shall be Scotchkote™ as manufactured by 3M™, or an 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, in the presence of the Engineer. The test shall be performed per this item and prior to any activity that will affect 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, in the presence of 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.

108-2.12 Detectable warning tape. Plastic, detectable, American Wood Preservers Association (AWPA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend magnetic tape shall be polyethylene film with a metalized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item.
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 unless otherwise authorized in writing by the Engineer or shown on the plans.

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.

************************************************************************************

The Engineer should determine and specify on the plans an adequate number of locations for installing L-823 connectors to provide maintenance and test points.

************************************************************************************

Provide not less than 3 feet (1 m) 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 one foot (30 cm) vertically above the top of the access structure. This requirement also applies where primary cable passes through empty light bases, junction boxes, and access structures to allow for future connections, or as designated by the Engineer.

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, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans.

108-3.2 Installation in duct banks or conduits. This item includes the installation of the cable in duct banks or conduit per the following paragraphs. 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 per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

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 that any potential interference is avoided.

Duct banks or conduits shall be installed as a separate item per 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 ensure that the duct bank or conduit is open, continuous and clear of debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be
kept closed except when installing cables. Cleaning of ducts, light bases, 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 re-cleaned at the Contractor’s expense. 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 that prevents harmful stretching of the conductor, damage 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 hand winch or power winch with the use of cable grips or pulling eyes. Maximum pulling tensions shall not exceed the cable manufacturer’s recommendations. A non-hardening cable-pulling lubricant recommended for the type of cable being installed shall be used where required.

The Contractor shall submit the recommended pulling tension values to the Engineer prior to any cable installation. If required by the Engineer, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the Engineer. Cable pull tensions shall be recorded by the Contractor and reviewed by the Engineer. Cables exceeding the maximum allowable pulling tension values shall be removed and replaced by the Contractor at the Contractor’s expense.

The manufacturer’s minimum bend radius or 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 use other appropriate means to prevent abrasion to the cable jacket.

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 shall be unreeled uniformly in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable 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 inches (75 mm) vertical displacement shall be provided with the topmost cable depth at or below the minimum required depth below finished grade.

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 (0.5 m) below finished grade per NEC Table 300.5, except as follows:

(1) When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches (91 cm) unless otherwise specified.
(2) Minimum cable depth when crossing under a railroad track, shall be 42 inches (1 m) unless otherwise specified.

Dewatering necessary for cable installation, erosion and turbidity control, per 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 (150 mm). 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 (75 mm) 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 (6 mm) 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 cables cross proposed installations, the Contractor shall ensure that these cables 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 (75 mm) deep, loose measurement, and shall be either earth or sand containing no mineral aggregate particles that would be retained on a 1/4 inch (6 mm) sieve. This layer shall not be compacted. The second layer shall be 5 inches (125 mm) deep, loose measurement, and shall contain no particles that would be retained on a one inch (25 mm) sieve. The remaining third and subsequent layers of backfill shall not exceed 8 inches (20 cm) of loose measurement and be excavated or imported material and shall not contain stone or aggregate larger than 4 inches (100 mm) 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.

If the cable is to be installed in locations or areas where other compaction requirements are specified (under pavements, embankments, etc.) the compaction requirements per Item P-152 for that area shall be followed.

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 per 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 6 inches (150 mm) above the direct-buried cable or the counterpoise wire if present. A 4-6 inch (100 - 150 mm) 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 inch (200 mm) minimum below finished grade.

c. Restoration. Following restoration of all trenching near airport movement surfaces, the Contractor shall visually inspect the area for foreign object debris (FOD) and remove any that is found. 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, and 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.

The Engineer is to specify the correct method of turfing and include in the construction documents the appropriate FAA turfing specification for restoration related to the installation of the power cables.

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 (0.5 m) 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 inch (10 - 15 cm) thick, extending approximately one 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 (61 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.

At the location of each underground cable connection, except at lighting units, or isolation transformers, or power a concrete marker slab must mark adapters 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
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concrete. After placement, all cable or splice markers shall be given one coat of high-visibility aviation orange paint as approved by the Engineer. 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 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 per the manufacturer’s instructions and to the satisfaction of the Engineer.

b. Field-attached plug-in splices. These shall be assembled per the 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 (38 mm) on each side of the joint.

c. 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 (38 mm) on each side of the joint.

d. Taped or heat-shrink 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 one 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.

Surfaces of equipment or conductors being terminated or connected shall be prepared in accordance with industry standard practice and manufacturer’s recommendations. All surfaces to be connected shall be thoroughly cleaned to remove all dirt, grease, oxides, nonconductive films, or other foreign material. Paints and other nonconductive coatings shall be removed to expose base metal. Clean all surfaces at least 1/4 inch (6.4 mm) beyond all sides of the larger bonded area on all mating surfaces. Use a joint compound suitable for the materials used in the connection. Repair painted/coated surface to original condition after completing the connection.
108-3.6 Bare counterpoise wire installation for lightning protection and grounding. If shown on the plans or included in the job specifications, bare solid [ #6 AWG ] copper counterpoise wire shall be installed for lightning protection of the underground cables. The Engineer shall select one of two methods of lightning protection for the airfield lighting circuit based on the frequency of local lightning:

**a. Equipotential.** – may be used by the Engineer for areas that have high rates of lightning strikes. This is where the counterpoise is bonded to the light base (edge lights included) and counterpoise size is determined by the Engineer.

**b. Isolation** – used in areas where lightning strikes are not common. The counterpoise is not bonded to edge light fixtures, in-pavement fixtures are boned to the counterpoise. Counterpoise size is selected by the Engineer.

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.

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**The Engineer shall select one of the two methods of lightning protection for the airfield lighting circuit.**

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[ For edge light fixtures installed in turf (stabilized soils) and for raceways or cables adjacent to the full strength pavement edge, the counterpoise conductor shall be installed halfway between the pavement edge and the light base, mounting stake, raceway, or cable.

The counterpoise conductor shall be installed 8 inches (203 mm) minimum below grade.

Each light base or mounting stake shall be provided with a grounding electrode.

When a metallic light base is used, the grounding electrode shall be bonded to the metallic light base or mounting stake with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

When a nonmetallic light base is used, the grounding electrode shall be bonded to the metallic light fixture or metallic base plate with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor. ]

[ For raceways installed under pavement; for raceways and cables not installed adjacent to the full strength pavement edge; for fixtures installed in full strength pavement and shoulder pavement and for optional method of edge lights installed in turf (stabilized soils); and for raceways or cables adjacent to the full strength pavement edge, the counterpoise conductor shall be centered over the raceway or cable to be protected as described below.

The counterpoise conductor shall be installed no less than 8 inches (203 mm) above the raceway or cable to be protected, except as permitted below.

The minimum counterpoise conductor height above the raceway or cable to be protected shall be permitted to be adjusted subject to coordination with the airfield lighting and pavement designs.
Where raceway is installed by the directional bore, jack and bore, or other drilling method, the counterpoise conductor shall be permitted to be installed concurrently with the directional bore, jack and bore, or other drilling method raceway, external to the raceway or sleeve.

The counterpoise conductor shall be installed no more than 12 inches (305 mm) above the raceway or cable to be protected.

The counterpoise conductor height above the protected raceway(s) or cable(s) shall be calculated to ensure that the raceway or cable is within a 45-degree area of protection.

The counterpoise conductor shall be bonded to each metallic light base, mounting stake, and metallic airfield lighting component.

All metallic airfield lighting components in the field circuit on the output side of the constant current regulator (CCR) or other power source shall be bonded to the airfield lighting counterpoise system.

The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet (150 m) 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:

c. A ground rod installed at and securely attached to each light fixture base, mounting stake, and to all metal surfaces at junction/access structures via #6 AWG wire.

d. For parallel voltage systems only, install a #6 AWG green insulated equipment ground conductor internal to the conduit system and securely attached it to each light fixture base internal grounding lug and to all metal surfaces at junction/access structures. Dedicated ground rods shall be installed and exothermically welded to the counterpoise wires at each end of a duct bank crossing under pavement.

Where an existing airfield lighting system is being extended or modified, the new counterpoise conductors shall be interconnected to existing counterpoise conductors at each intersection of the new and existing airfield lighting counterpoise systems.

108-3.7 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 area 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 22-1/2 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.

108-3.8 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.
108-3.9 **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:

a. All slag shall be removed from welds.

b. Using an exothermic weld to bond the counterpoise to a lug on a galvanized light base is not recommended unless the base has been specially modified. Consult the manufacturer’s installation directions for proper methods of bonding copper wire to the light base. See also AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.10 **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 shall perform all tests in the presence of 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. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

a. 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.

b. 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:

c. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.

d. That all affected circuits (existing and new) are free from unspecified grounds.

e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than [___] megohms.

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**Engineer shall determine minimum insulation resistance value based upon system design criteria and area experience. Minimum value shall be that recommended in AC 150/5340-26.**

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f. That the insulation resistance to ground of all new non-grounded conductors of new multiple circuits or circuit segments is not less than 100 megohms.

g. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.
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.

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 used, as described by American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81, to verify this requirement. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. Test equipment and its calibration sheets shall be submitted for review and approval by the Engineer prior to performing the testing.

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.

**METHOD OF MEASUREMENT**

**108-4.1** Trenching shall be measured by the linear feet (meters) of trench, including the excavation, backfill, and restoration, completed, measured as excavated, and accepted as satisfactory. When specified, separate measurement shall be made for trenches of various specified widths.

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.

The Engineer shall select whether trenching will be measured separately or included in the installation of the cable or counterpoise. Paragraphs 108-4.1 and 108-5.1 shall be modified accordingly.

**108-4.2** Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet (meters) installed 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.

The Engineer is to decide if the quantity of cable provided in the bid tabulations includes an estimated quantity for slack. If so, this should be clearly identified on the plans and specifications. If not, add the following language at the end of paragraph 108-4.2:
“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.”

108-4.3 Ground rods shall be measured by each [8-foot] section installed complete.

**BASIS OF PAYMENT**

108-5.1 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.

Payment will be made under:

- **Item L-108-5.1** Trenching for direct-buried cable, 18 inch minimum depth - per linear foot (meter)
- **Item L-108-5.2** No. 8 AWG, No. 6 AWG, 5 kV, 600V, L-824, Type C, Type B Cable, Installed in Trench, Duct Bank or Conduit - per linear foot (meter)
- **Item L-108-5.3** No. 6 AWG, Solid, Bare Counterpoise Wire, Installed in Trench, Above the Duct Bank or Conduit, Including Ground Rods and Ground Connectors - per linear foot (meter)
- **Item L-108-5.4** No. 6 AWG, Bare Insulated, Stranded Equipment Ground, Installed in Duct Bank or Conduit – per linear foot (meter)

Engineer to specify appropriate size of cable. If more than one size is required on the project, provide additional item nos.; one for each size and type.

**MATERIAL REQUIREMENTS**

- AC 150/5340-26 Maintenance of Airport Visual Aid Facilities
- AC 150/5340-30 Design and Installation Details for Airport Visual Aids
- 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
- AC 150/5345-53 Airport Lighting Equipment Certification Program
- Commercial Item Description A-A-59544 Cable and Wire, Electrical (Power, Fixed Installation)
Commercial Item Description A-A-55809

Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

ASTM B3 Standard Specification for Soft or Annealed Copper Wire

ASTM B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM B33 Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes

ASTM D4388 Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes

FED SPEC J-C-30 Cable and Wire, Electrical (Power, Fixed Installation)

MIL-I-24391 Insulation Tape, Electrical, Plastic, Pressure Sensitive

REFERENCE DOCUMENTS

NFPA-70 National Electrical Code (NEC)

NFPA-780 Standard for the Installation of Lightning Protection Systems

MIL-S-23586F Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical


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Item L-109 Airport Transformer Vault and Vault Equipment

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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 or buried in sand) installed per this specification at the locations and per 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, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per 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 requested by the Engineer.

b. Manufacturer’s certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, that comply with these specifications, at the Contractor’s cost.

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 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 made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue 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 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 that do not meet the system design and the standards and codes specified in this document.

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.

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The Engineer should specify the form in which submittals are to be received and number of copies.

The length of time for guarantee of materials and workmanship should be as stated in the contract between the Owner and Contractor and the contract special provisions.

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110-2.2 Steel conduit. Rigid galvanized steel (RGS) conduit and fittings shall be hot dipped galvanized inside and out and conform to the requirements of Underwriters Laboratories Standards 6, 514B, and 1242. All RGS conduits or RGS elbows installed below grade, in concrete, permanently wet locations or other similar environments shall be painted with a 10 mil thick coat of asphaltum sealer or shall have a factory bonded polyvinyl chloride (PVC) cover. Any exposed galvanizing or steel shall be coated with 10 mil of asphaltum sealer. When using PVC coated RGS conduit, care shall be exercised not to damage the factory PVC coating. Damaged PVC coating shall be repaired per the manufacturer's written instructions.

110-2.3 Plastic conduit. Plastic conduit and fittings shall conform to the following requirements:

- UL 514B covers W-C-1094-Conduit fittings all types, classes 1 thru 3 and 6 thru 10.
- UL 514C covers W-C-1094- all types, Class 5 junction box and cover in plastic (PVC).
- UL 651 covers W-C-1094-Rigid PVC Conduit, types I and II, Class 4.
- UL 651A covers W-C-1094-Rigid PVC Conduit and high density polyethylene (HDPE) Conduit type III and Class 4.

Underwriters Laboratories Standards UL-651 and Article 352 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.

c. Type III – Schedule 80 PVC suitable for either above ground or underground use either direct-buried or encased in concrete.

d. Type III – HDPE pipe, minimum standard dimensional ratio (SDR) 11, suitable for placement with directional boring under pavement.

The type of solvent cement 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 plastic.

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 shall conform to 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 A615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

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Typically, the maximum size aggregate should be specified as one inch (25 mm); however, Engineer may specify smaller to accommodate special situations where one inch (25 mm) aggregate may be too large.

Item P-610 requires concrete to develop a 28-day compressive strength of 4,000 psi. Engineer to determine the strength of concrete appropriate for the project and insert in paragraph 110-2.6.

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110-2.7 Flowable backfill. Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material. Fill shall be designed to achieve a 28-day compressive strength of 200 psi (1.4 MPa) under pavement.

110-2.8 Detectable warning tape. Plastic, detectable, American Wood Preservers Association (AWPA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend magnetic tape shall be polyethylene film with a metallized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item.

Specify color and legend.

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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 (50 mm) 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 (75 mm) per 100 feet (30 m). 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. Pockets or traps where moisture may accumulate shall be avoided. No duct bank or underground conduit shall be less than 18 inches (0.5 m) below finished grade. Where under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade.

For a closed conduit/duct bank system, the system should be designed to be connected to, and thus drain into, the airfield storm drainage system.

Engineer needs to be careful to define the term “subgrade” as it relates to pavement construction. In areas of pavement construction requiring the placement of
embankment, or in areas requiring over-excavation to remove unsuitable material, the desired location of the top of the duct bank needs to be clearly identified in areas susceptible to frost, the top of the duct bank should be placed at or below the level of the frost line.

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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 (6 mm) 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 light bases, manholes, 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 (90 kg) 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 contaminants 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 (1.5 m).

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

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.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) 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 (6 mm) 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 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 the proposed warning tape for approval by the Engineer. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per 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 (60 cm).

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 per Item P-152 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 L-110 pay item of which it is a component part. Dewatering necessary for duct installation, erosion and turbidity control, per Federal, state, and local requirements is incidental to its respective pay item as a part of 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 per Item P-152.

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 ensure that these cables 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:

   a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

   b. 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.

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 (0.5 m) 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 (0.5 m) 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 (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains 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, 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 (75 mm) thick.
prior to its initial set. The Contractor shall space the conduits not less than 3 inch (75 mm) apart (measured from outside wall to outside wall). 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 (75 mm) thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) 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 (1.5-m) 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.

When specified, 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 (1.5-m) intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut 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, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

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. 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 be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport’s secured area where trespassing is prohibited are at least 18 inches (0.5 m) below the finished grade. Conduits outside the Airport’s secured area shall be installed so that the tops of the conduits are at least 24 inches (60 cm) below the finished grade per National Electric Code (NEC), Table 300.5.

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 3 inches (75 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 be placed not less than 3 inches (75 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.

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 (150 mm) 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 (1.5-m) 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 one 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. Each cable or duct run from a line of lights and signs to the equipment vault must be marked at
approximately every 200 feet (61 m) along the cable or duct run, with an additional marker at each
change of direction of cable or duct run.

The Contractor shall impress the word “DUCT” or “CONDUIT” on each marker slab. Impression of
letters shall be done in a manner, approved by the Engineer, for a neat, professional appearance. All
letters and words must be neatly stenciled. After placement, all markers shall be given one coat of high-
visibility orange paint, as approved by the Engineer. 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 mm) 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 per Item P-152
“Excavation and Embankment” except that material used for back fill shall be select material not larger
than 4 inches (100 mm) 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 per 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 per Item P-152 “Excavation and Embankment” except that the material used for
backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the
requirements of P-152, where duct banks are installed under pavement, one moisture/density test per lift
shall be made for each 250 linear feet (76 m) 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 per 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 [ sodding ][ topsoiling ][ fertilizing ][ liming ][ seeding ][ spraying ][ mulching ] shown on the plans. 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 pay item. Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

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Engineer to specify the correct method of turfing and include in the construction documents the appropriate FAA turfing specification for restoration related to the installation of such duct banks and conduits.

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**METHOD OF MEASUREMENT**

**110-4.1** 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 material, 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** 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 per the provisions and intent of the plans and specifications.

Payment will be made under:

- **Item L-110-5.1** [ Concrete Encased ][ Non-Encased ] Electrical Duct Bank, [ # and Size ] - per linear foot (meter)
- **Item L-110-5.2** [ Concrete Encased ][ Non-Encased ] Electrical Conduit, [ # and Size ] - per linear foot (meter)

**MATERIAL REQUIREMENTS**

Advisory Circular (AC) 150/5340-30
Design and Installation Details for Airport Visual Aids
AC 150/5345-53  Airport Lighting Equipment Certification Program
ASTM A615  Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM D1556  Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557  Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft$^3$(2,700 kN-m/m$^3$))
ASTM D2167  Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2922  Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
NFPA-70  National Electrical Code (NEC)
Underwriters Laboratories Standard 6  Electrical Rigid Metal Conduit - Steel
Underwriters Laboratories Standard 514B  Conduit, Tubing, and Cable Fittings
Underwriters Laboratories Standard 514C  Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
Underwriters Laboratories Standard 1242  Electrical Intermediate Metal Conduit Steel
Underwriters Laboratories Standard 651  Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
Underwriters Laboratories Standard 651A  Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110
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Item L-115 Electrical Manholes and Junction Structures

DESCRIPTION

115-1.1 This item shall consist of electrical manholes and junction structures (hand holes, pull boxes, junction cans, etc.) installed per 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 responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications at the Contractor’s cost.

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 products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue 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 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 that do not meet the system design and the standards and codes, specified in this document.

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 the date of 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 Engineer should specify the form in which submittals are to be received and number of copies.

The length of time for guarantee of materials and workmanship should be as stated in the contract between the Owner and Contractor and the contract special provisions.

115-2.2 Concrete structures. Cast-in-place concrete structures shall be per 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 [ ___ lb aircraft ] loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.

Engineer to specify load characteristics for precast concrete structure based on design aircraft. It is the intent of this specification for the design Engineer to design a cast-in-place structure that is detailed on the plans that will be suitable for the design loads and subgrade soil characteristics. If the Contractor proposes to use a substitute structure design, design calculations shall be submitted according to the procedure in the General Provisions.

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 per the process defined in the General Provisions.

115-2.3 Junction boxes. Junction boxes shall be L-867 Class 1 (non-load bearing) or L-868 Class 1 (load bearing) airport light bases that are encased in concrete. The light bases shall have a galvanized steel blank cover, gasket, and stainless steel or coated steel hardware per FAA Engineering Brief (EB) #83. Covers shall be 3/8-inch (9-mm) thickness for L-867 and 3/4-inch (19-mm) thickness for L-868.

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 be per the requirements in ASTM C150, Type I. The sand shall be per the requirements in ASTM C144. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15% of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C6. Water shall be potable, reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product.

115-2.5 Concrete. All concrete used in structures shall conform to the requirements of Item P-610, Structural Portland Cement Concrete.

115-2.6 Frames and covers. The frames shall conform to one of the following requirements:
   a. ASTM A48 Gray iron castings
b. ASTM A47   Malleable iron castings

c. ASTM A27   Steel castings

d. ASTM A283, Grade D   Structural steel for grates and frames

e. ASTM A536   Ductile iron castings

f. ASTM A897   Austempered ductile iron castings

All castings specified shall withstand a maximum tire pressure of [____] psi and maximum load of [____] lbs.

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Engineer to specify load characteristics for castings based on design aircraft.

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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.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

Each cover shall have the word “ELECTRIC” or other approved designation cast on it. Each frame and cover shall be as shown on the plans or approved equivalent. No cable notches are required.

Each manhole shall be provided with a “DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER” safety warning sign as detailed in the Contract Documents and in accordance with OSHA 1910.146 (c)(2).

115-2.7 Ladders. Ladders, if specified, shall be galvanized steel or as shown on the plans.

115-2.8 Reinforcing steel. All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A615, 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, plastic, or aluminum. Cable trays shall be located as shown on the plans.

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Engineer to specify cable tray based on type of structure and user preference.

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115-2.13 Conduit terminators. Conduit terminators shall be 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 (22 mm) diameter hot-dipped galvanized steel or stress-relieved carbon steel roping designed for concrete applications (7 strand, 1/2 inch (12 mm) diameter with an ultimate strength of 270,000 psi (1862 MPa)). 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, [solid stainless steel] [copper] or [copper clad]. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 8 feet (2.4 m) long nor less than 5/8 inch (16 mm) in diameter.

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Engineer should evaluate the soils in the vicinity of proposed counterpoise and ground rod installations and determine if soil conditions would adversely affect copper. Engineer shall specify the type of ground rod and counterpoise wire to be installed in consideration of the soil conditions.
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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, per 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 (150 mm) 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 6 inches (150 mm) 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 (150 mm) in thickness measured after compaction to the density requirements in 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.
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 (150 mm) above the floor. The ground rod shall be installed within one foot (30 cm) of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab. 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 (100 mm) 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 one foot (30 cm) above the floor of the structure and separate from other cables. No. 2 American wire gauge (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. If an exothermic weld is not possible, connections to the grounding bus shall be made by using connectors approved for direct burial in soil or concrete per UL 467. 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 per MIL-P-21035. Surfaces shall be prepared and compound applied per the 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.

Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.
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 using the fall-of-potential ground impedance test per American National Standards Institute / Institute of Electrical and Electronic Engineers (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.

The Engineer should require the precast sections be designed per paragraph 115-2.2.

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 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 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
- Item L-115-5.4 Electrical Handhole [Size and Type] - Per Each

MATERIAL REQUIREMENTS

- Advisory Circular (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
- AC 150/5345-42 Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
- AC 150/5340-30 Design and Installation Details for Airport Visual Aids
- AC 150/5345-53 Airport Lighting Equipment Certification Program
- Commercial Item Description A-A 59544 Cable and Wire, Electrical (Power, Fixed Installation)
- ASTM A27 Standard Specification for Steel Castings, Carbon, for General Application
<table>
<thead>
<tr>
<th>Standard</th>
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<tbody>
<tr>
<td>ASTM A283</td>
<td>Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates</td>
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<tr>
<td>ASTM A536</td>
<td>Standard Specification for Ductile Iron Castings</td>
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<tr>
<td>ASTM A615</td>
<td>Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement</td>
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<td>ASTM A897</td>
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<td>Standard Specification for Aggregate for Masonry Mortar</td>
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<td>Standard Specification for Finishing Hydrated Lime</td>
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<td>MIL-P-21035</td>
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**END OF ITEM L-115**
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Item L-119: Airport Obstruction Lights

NOT USED

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