PROJECT NO. 10.10.0060

TAXIWAY REHAB PROJECT
AT
APPLE VALLEY AIRPORT

APPLE VALLEY, CALIFORNIA

AUGUST 2024

SAN BERNARDINO COUNTY
PROJECT AND FACILITIES MANAGEMENT DEPARTMENT
385 NORTH ARROWHEAD AVENUE
SAN BERNARDINO, CA 92415-0184
https://res.sbcounty.gov/

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Kenneth Gethers 8/13/2024
Kenneth Gethers, PE **Date**

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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 AIP. The Airport Improvement Program, a grant-in-aid program, administered by the Federal Aviation Administration.

10-05 AIR OPERATIONS AREA. For the purpose of these specifications, the term air operations area 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. The name of the Airport where this project is located is Apple Valley Airport, located in the Town of Apple Valley, San Bernardino County, California.

10-07 ASTM. The American Society for Testing and Materials.

10-08 AWARD. The acceptance, by the Owner, of the successful bidder's proposal.

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, shall 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: The Advertisement; The Proposal; The Agreement; The Performance Bond; The Payment Bond; any required insurance certificates; The Specifications; The 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 completion date 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.

10-17 DRAINAGE SYSTEM. The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

10-18 ENGINEER. The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering inspection of the contract work and acting directly or through an authorized representative. . The Engineer for this project is C&S Engineers, Inc., 2020 Camino Del Rio North, Suite 1000, San Diego, California 92108.

10-19 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.

10-20 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.

10-21 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/her duly authorized representative.

10-22 FEDERAL SPECIFICATIONS. The Federal Specifications and Standards, Commercial Item Descriptions, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government. They may be obtained from:

DODSSP
Standardization Document Order Desk
700 Robbins Avenue, Bldg. 4D
Philadelphia, PA 19111-5094

10-23 FORCE ACCOUNT. Force account construction work is construction that is accomplished through the use of material, equipment, labor, and supervision provided by the Owner or by another public agency pursuant to an agreement with the Owner.

10-24 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.

10-25 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.

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.

10-26 LABORATORY. The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer.

10-27 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.

10-28 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 percent of the total amount of the award contract. All other items shall be considered minor contract items.

10-29 MATERIALS. Any substance specified for use in the construction of the contract work.

10-30 NOTICE TO PROCEED. 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.

10-31 OWNER. The term "Owner" shall mean the party of the first part or the contracting agency signatory to the contract. For AIP contracts, the term "sponsor" shall have the same meaning as the term "Owner." Where the term "Owner" is capitalized in this document, it shall mean airport owner or sponsor only.

Whenever the words "Owner", "Sponsor", "San Bernardino County", "County", "Apple Valley Airport", "Airport" or "Party of the first part" are used, the same are understood to mean the San Bernardino County or its representative duly authorized to act.

10-32 PAVEMENT. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-33 PAYMENT BOND. The approved form of security furnished by the Contractor and his/her surety as a guaranty that he will pay in full all bills and accounts for materials and labor used in the construction of the work.

10-34 PERFORMANCE BOND. The approved form of security furnished by the Contractor and his/her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.

10-35 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.

10-36 PROJECT. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-37 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. For AIP contracts, the term "bid" shall have the same meaning as the term "proposal."

10-38 PROPOSAL GUARANTY. The security furnished with a proposal to guarantee that the bidder will enter into a contract if his/her proposal is accepted by the Owner.

10-39 RUNWAY. The area on the airport prepared for the landing and takeoff of aircraft.

10-40 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.

10-41 SPONSOR. See definition above of "Owner."

10-42 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.

10-43 SUBGRADE. The soil that forms the pavement foundation.

10-44 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.

10-45 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 percent, 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.

10-46 SURETY. The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.

10-47 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 or aircraft parking areas.

10-48 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.

10-49 WORKING DAY. A Working Day shall be defined as an eight (8) hour shift of work on any day other than a legal holiday, Saturday, or Sunday.

One day shall be charged against Contract Time for any Working Day on which the Contractor is able to proceed with work for at least six (6) hours toward completion of the Contract. One-half day shall be charged against Contract Time for any Working Day on which the Contractor is able to proceed with work for at least three (3) hours toward completion of the Contract.

Legal holidays, Saturdays and Sundays on which the Contractor chooses to engage in work, requiring the presence of an inspector, will be considered Working Days. Working Days will not be charged against Contract Time if work is suspended for causes beyond the Contractor's control.

10-50 CONTRACT DRAWINGS. The Plans.

10-51 DESIGN ENGINEER. The individual(s), partnership(s), firm(s), or corporation(s) duly authorized by the Owner to be responsible for design services. The Design Engineer for this project is C&S Engineers, Inc. 2020 Camino Del Rio North, San Diego, California 92108.

10-52 SUBCONTRACTOR. The subcontractor refers any individual, firm, or corporation to whom the contractor, with approval of the Owner, sublets any part of work.

10-53 TIME AND MATERIALS WORK. An item or items 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 and an agreed price cannot be agreed upon. The Contractor shall perform this work and the Owner agrees to pay the Contractor based upon the work performed by the Contractor's employees and subcontractors, and for materials and equipment used in the construction (along with the Contractor's allowed overhead and profit).

END OF SECTION 10

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.

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 quantities, provided that the aggregate of such alterations does not change the total contract cost or the total cost of any major contract item by more than 25 percent (total cost being based on the unit prices and estimated quantities in the awarded contract). Alterations that do not exceed the 25 percent 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 percent 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.

All supplemental agreements 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 increase or decrease the originally awarded contract or any 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 nonperformed, 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.

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, he may order the Contractor to proceed with Extra Work by force account as provided in the General Conditions.

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 hereinbefore defined in the subsection 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.

Extra work to be performed on the basis of agreed prices where no applicable unit or lump sum prices have been included in the Contract shall be based upon the Contractor's price analysis for the work. The price analysis will be completed as outlined in the General Conditions.

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. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas of the airport with respect to his/her own operations and the operations of all his/her subcontractors as specified in the subsection 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 thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in the General Provisions.

With respect to his/her own operations and the operations of all his/her 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 furnish erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the manual of Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office), unless otherwise specified herein. 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. Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.

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 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, he may at his/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 his/her 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., he 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/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 his/her use of such material so 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/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 CLEANING UP. 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. He 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 DEBRIS. The Contractor shall remove all debris and rubbish resulting from his work at frequent intervals, and upon the order of the Engineer. Upon completion, Contractor shall leave the premises broom-clean and everything in perfect order and repair. Upon neglect or refusal of Contractor to keep the premises clean, the Engineer shall have the authority to have such work performed, and the cost of the same shall be charged to the Contractor in default and collected from any monies which have or may

become due on this Contract; and the Engineer shall issue no certificates of payment on the Contract until premises are clean, in good order, and all claims created properly adjusted.

END OF SECTION 40

Section 50 Control of Work

50-01 AUTHORITY OF THE ENGINEER. The Engineer shall decide all questions that may arise as to the interpretation of the specifications or plans relating to the work.

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/her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, he will advise the Owner of his/her determination that the affected work be accepted and remain in place. In this event, the Engineer will document his/her 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 good engineering judgment and such tests or retests of the affected work as are, in his/her opinion, needed. Changes in the contract price shall be covered by contract modifications (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 prosecution 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 good engineering judgment in his/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 FAA advisory circulars; contract general provisions shall govern over plans, cited standards for materials or testing, and cited FAA advisory circulars; plans shall govern over cited standards for materials or testing and cited FAA advisory circulars.

From time to time, discrepancies within cited standards for testing occur due to the timing of changing, editing, and replacing of standards. In the event the Contractor discovers any apparent discrepancy within standard test methods, he shall immediately call upon the Engineer for his/her interpretation and decision, and such decision shall be final.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, he shall immediately call upon the Engineer for his/her interpretation and decision, and such decision shall be final.

50-04 COOPERATION OF CONTRACTOR. The Contractor will be supplied with five copies each of the plans and specifications. He 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 he shall cooperate with the Engineer and his/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/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/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 his/her 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/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 by him because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange his/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. He shall join his/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 Design Engineer will 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 Design Engineer may have set for either his/her own or the Contractor's guidance shall be preserved by the Contractor. In case of negligence on the part of the Contractor, or his/her 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 prosecution and control of the work contracted for under these specifications.

If requested by the Engineer, the Contractor must give weekly copies of the survey notes to the Engineer so that the Engineer may check them as to accuracy and method of staking. All areas that are staked by the Contractor must be checked by the Engineer prior to beginning any work in the area. The Engineer

will make periodic checks of the grades and alignment set by the Contractor. In case of error on the part of the Contractor, or his/her employees, resulting in establishing grades and/or alignment that are not in accordance with the plans, all construction not in accordance with the established grades and/or alignment shall be replaced without additional cost to the Owner.

Additional construction staking and layout may be required by technical specifications. Construction Staking and Layout includes at a minimum, but is not limited to:

A. Clearing and Grubbing perimeter staking.

B. Rough Grade slope stakes at 100-foot stations.

C. Drainage Swales slope stakes and flow line blue tops at 50-foot stations.

D. Subgrade blue tops at 25-foot stations and 25-foot offset distance (max.) for the following section locations:

   1. Runway – minimum 5 per station

   2. Taxiways – minimum 3 per station

   3. Holding apron areas – minimum 3 per station

   4. Roadways – minimum 3 per station

E. Base Course blue tops at 25 foot stations and 25-foot offset distance (max.) for the following section locations:

   1. Runway – minimum 5 per station

   2. Taxiways – minimum 3 per station

   3. Holding apron areas – minimum 3 per station

F. Pavement areas:

   1. Edge of Pavement hubs and tacks (for stringline by Contractor) at 100-foot stations

   2. Between Lifts at 25-foot stations for the following section locations:

      a. Runways – each paving lane width

      b. Taxiways – each paving lane width

      c. Holding areas – each paving lane width

   3. After finish paving operations at 50-foot stations

      a. All paved areas – Edge of each paving lane prior to next paving lot

   4. Shoulder and safety area blue tops at 50-foot stations and at all break points with maximum of 50 foot offsets

G. Fence lines at 100-foot stations

H. Electrical and Communications System locations, lines and grades including but not limited to duct runs, connections, fixtures, signs, lights, VASIs, PAPIs, REILs, Wind Cones, Distance Markers (signs), pull boxes and manholes.

I. Drain lines, cut stakes and alignment on 25-foot stations, inlet and manholes.

J. Painting and Striping layout (pinned with 1.5 in PK nails) marked for paint Contractor. (All nails shall be removed after painting)

Laser, or other automatic control devices, shall be checked with temporary control point or grade hub at a minimum of once per 400 feet per pass (that is, paving lane).

Note: 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 employed by the Owner 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 employed by the Owner are authorized to notify the Contractor or his/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 his/her decision.

50-09 INSPECTION OF THE WORK. All materials and each part or detail of the work shall be subject to inspection by the Engineer. 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 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 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 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 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 given by the Engineer. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans or as given, 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 forthwith 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/her hauling equipment and shall correct such damage at his/her own expense.

50-12 MAINTENANCE DURING CONSTRUCTION. The Contractor shall maintain the work during construction and until the work is accepted. This 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.

50-13 FAILURE TO MAINTAIN THE WORK. Should the Contractor at any time fail to maintain the work as provided in the subsection 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 prosecution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, he 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, he may accept it as being completed, 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.

50-15 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 completed 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.

50-16 CLAIMS FOR ADJUSTMENT AND DISPUTES. If for any reason the Contractor deems that additional compensation is due him for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, he shall notify the Engineer in writing of his/her intention to claim such additional compensation before he begins the work on which he 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 his/her written claim to the Engineer who will present it to the Owner for consideration in accordance with local laws or ordinances.

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 REMOVAL OF WATER. The Contractor shall at all times during construction, provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of materials or other work.

Removal of water includes the construction and removal of cofferdams, sheeting and bracing, the furnishing of materials and labor necessary therefore, the excavation and maintenance of ditches and

sluiceways and the furnishing and operation of pumps, wellpoints and appliances needed to maintain thorough drainage of the work in a satisfactory manner.

Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least twenty-four (24) hours after placement and no stream of water shall be allowed to flow over such work until such time as the Engineer may permit.

Unless otherwise specified, all excavations which extend down to or below the static groundwater elevations at the sites of structures shall be dewatered by lowering and maintaining the groundwater beneath such excavations at an elevation not less than that specified herein at all times when work thereon is in progress, during subgrade preparation and the placing of the structure or other materials thereon.

Where the presence of fine granular subsurface materials and a high groundwater table may cause the upward flow of water into the excavation with a resulting quick condition, the Contractor shall install and operate a suitable dewatering system to prevent the upward flow of water during construction.

When the water table is within the capillary rise of silt/clay subsurface material, the Contractor shall select and operate his equipment in a manner to prevent the deterioration of the working surface due to the upward flow of water during construction.

The effluent pumped from the dewatering system shall be examined periodically by qualified personnel to determine if the system is operating satisfactorily without the removal of fines.

Unless otherwise directed by the Engineer or shown on the Contract Documents, the water level shall not be permitted to rise until construction in the immediate area is completed and the excavation backfilled to the original grade or proposed grade.

Where well points are used, the groundwater shall be lowered and maintained continuously (day and night) at a level not less than two (2) feet below the bottom of the excavation. Excavation will not be permitted at a level lower than two (2) feet above the water level as indicated by the observation wells.

The wellpoint system shall be designed or installed by or under the supervision of an organization whose principal business is wellpointing and has at least five (5) consecutive years of similar experience and can furnish a representative list of satisfactory similar operations. Wellpoint headers, points and other pertinent equipment shall not be placed within the limits of the excavation in such a manner or location as to interfere with the laying of pipe or trenching operations or with the excavation for and/or construction of other structures. Standby gasoline or diesel powered equipment shall be provided so that in the event of failure of the operating equipment, the standby equipment can be readily connected to the dewatering system. The standby equipment shall be maintained in good order and actuated regularly not less than twice a week when directed.

Wellpoints shall be installed in the center of a sand wick drain which shall be placed by means of a sanding shell or other approved means to provide a sand core not less than ten (10) inches in diameter.

Detached observation wells of similar construction to the wellpoints shall be installed at intervals of not less than fifty (50) feet along the opposite side of the trench from the header pipe and line of wellpoints, or around the excavation for a structure or as shown on the Contract Drawings, to a depth of at least five (5) feet below the proposed excavation. In addition, one wellpoint in every fifty (50) feet shall be fitted with a tee, plug and valve so that the wellpoint can be converted for use as an observation well. Observation wells shall be not less than one and one-half (12) inch in diameter.

Water pumped or drained from excavations, or any sewers, drains, or water courses encountered in the work, shall be disposed of in a suitable manner without injury to adjacent property, the work under construction, or to pavements, roads and drives. No water shall be discharged to sanitary sewers. Sanitary sewage shall be pumped to sanitary sewers or shall be disposed of by an approved method.

Any damage caused by improper handling of water shall be repaired by the Contractor at his/her own expense.

50-18 SHEETING AND BRACING. Excavations greater than five feet in depth are anticipated for this project. The Contractor shall comply with the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. Prior to beginning any trench or structure excavation exceeding 5 feet in depth, the Contractor shall submit to the Owner for acceptance a detailed plan showing the design of shoring, bracing, sloping, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system established in the Construction Safety Orders of the State of California, such alternative system plans shall be prepared by a licensed engineer in the State of California. The Contractor shall furnish, place and maintain such sheeting, bracing and shoring as required to support the sides and ends of excavations in such a manner as to prevent any movement which would in any way damage the pipe, sewers, masonry or other work, diminish the width necessary, otherwise damage or delay the work, or endanger existing structures, pipes or pavements, or to occasion a hazard to persons engaged on the project or to the general public.

Sheeting and bracing or other trench protection shall be utilized as required for the safety of employees exposed to the hazard of falling or sliding material from any trench or excavation in conformance with the provisions of Industrial Code Rule 23 as amended, and OSHA. Sheeting and bracing must be designed by, signed and stamped by a Professional Engineer licensed to practice in the State in which the project is located.

The Contractor shall be responsible for the adequacy of all trench support systems used and for all damage to persons or property resulting from improper quality, strength, placing, maintenance and removal.

All material used for sheeting and bracing shall be sound and free from defects which might impair its strength or effectiveness.

All timber sheeting and bracing shall be sound and straight, free from cracks, shakes and large or loose knots.

All steel sheeting and bracing shall be sound and straight, free from bends, twists or splits, having square and undamaged ends.

Sheeting shall be driven vertically from the original ground surface as the excavation progresses. Sufficient toe support shall be sustained so as to maintain pressure against the original ground at all times.

Timber sheeting shall be driven so that edges are tight together and steel sheeting driven with the individual members interlocking. All bracing shall be of such design and strength as to maintain the sheeting in its proper position.

The Contractor shall be solely responsible for the adequacy of all sheeting and bracing.

In general, all sheeting and bracing, whether of steel, timber or other material, 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 pipe, sewer or structure shall be withdrawn, unless otherwise directed, before more than 6 inches of earth is placed above the top of the pipe, sewer or structure and before any bracing is removed. The 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 Contractor shall be responsible for the adequate shoring and/or bracing of any existing utilities encountered during the excavation. Such utilities shall be braced or shored in a manner acceptable to the local jurisdictional agency having authority over the utility encountered. It shall be the responsibility of the Contractor to prevent damage to or displacement of utilities, and to work with and request the concurrence of the utility's company representative in this matter.

END OF SECTION 50

Section 60 Control of Materials

60-01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS. The materials used on 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.

At the Engineer's option, materials may be approved at the source of supply before delivery is started. 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 FAA 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:

EQUIPMENT NAME	CITED FAA SPECIFICATION
Connectors, Cable	L-823
Underground Electrical Cable for Airport Lighting Circuits	L-824
Lights, Taxiway, In-pavement	L-852
Lights, Runway & Taxiway Edge, Medium Intensity	L-861
Light Base, Non-Load Bearing	L-867
Light Base, Load Bearing	L-868

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.

The Contractor shall prepare a project Operations and Maintenance (O&M) Manual for the Owner. The O&M Manual shall consist of approved certification submittals, approved shop and setting drawing submittals, approved catalogue data submittals, and Operations & Maintenance Manuals for equipment installed that have operating procedures and/or maintenance requirements associated with them. The O&M manual shall be neatly bound in a properly sized 3-ring binder and tabbed by specification section. The O&M Manual shall be submitted to the Engineer prior to final payment to facilitate project closeout.

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, tests in accordance with the cited standard methods of ASTM, 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 Owner. THE COST OF ALL FAILING TESTS SHALL BE BORNE BY THE CONTRACTOR.

The testing organizations performing on site field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel, including the Contractor's representative at his/her request. Unless otherwise designated, samples will be taken by a qualified representative of the Owner. 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 his/her request.

The Contractor shall employ a testing organization to perform all Contractor required 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. A legible, handwritten copy of all test data shall be given to the Engineer daily, along with printed reports, in an approved 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.

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. Manufacturer's certificates of compliance shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Design Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer, and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

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, he 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.

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/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 his/her 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 he 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 Required)

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 so as 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. Upon request, the Contractor shall furnish the Engineer a copy of the property owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at his/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 used in the work.

60-08 OWNER FURNISHED MATERIALS. The Contractor shall furnish all materials required to complete the work, except those specified herein (if any) to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified herein.

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 AND SETTING DRAWINGS AND CATALOGUE DATA. All materials and equipment used in the work shall be submitted to the Engineer for review by the Design Engineer for approval prior to ordering the equipment. All information required for the Design Engineer's review of each particular pay item shall be sent as one submittal. In addition, if the pay item interfaces with other pay items (as in the case of electrical equipment), then the submittals covering the interfacing pay items shall be sent at the same time. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Drawings and data shall be submitted sufficiently in advance of the work to permit proper review, including time for necessary revisions and re-submittals. The Contractor is solely responsible for delays in the project accruing directly or indirectly from late submissions or resubmissions of submittals.

Shop and setting drawings shall present complete and accurate information relative to all working dimensions, equipment weight assembly and sectional view, all the necessary details, pertaining to coordinating the work of the Contract, lists of materials and finishes, parts lists and the description thereof, lists of spare parts and tools where such parts or tools are required, no-scale control diagrams for control wiring and control piping, and any other items of information that are required to demonstrate detail compliance with the Plans and Specifications. Each drawing shall be dated and shall show the name of the Project, Contract Number and the name of the manufacturer of the equipment covered by the drawing or drawings. The Design Engineer will not review any drawings that are not properly identified or that do not contain complete data on the work or that have not been checked, stamped and signed by the Contractor for compliance with the Contract Documents.

The Design Engineer's review of the Contractor's Shop Drawings signifies only that such drawings appear to be in substantial conformity with the Contract Drawings and Contract Documents or with the Design Engineer's instructions. Such review does not indicate approval of every detail of the drawings nor of the work methods of the Contractor which are indicated thereon. Regardless of the corrections made in or made of such drawings by the Design Engineer, the Contractor will nevertheless be responsible for the accuracy of such drawings, for their conformity to the Plans and Specifications and for the proper fitting and construction of the work.

No work covered by shop and setting drawings shall be done until the drawings have been reviewed and found acceptable by the Design Engineer. No payment shall be made on any item for which submittals are not received and found acceptable by the Design Engineer.

60-10 ELECTRICAL SHOP DRAWINGS. Drawings for electrical equipment shall show physical dimensions and installation details and shall include elementary and connection diagrams for each control assembly and the interconnection diagrams for all equipment. The drawings shall show clearly the coordination of control work, shall identify the components external to electrical equipment and shall define the contact arrangement and control action of the primary and final control elements.

Where standard electrical control equipment having complex internal wiring is required, such as control panels, generator transfer panels, electric or electronic instruments and similar items, the detail shop wiring diagrams for such equipment will not be required, and, if submitted, will in general not be reviewed. The submittal for each such item of equipment shall, however, include an elementary diagram of the input and output elements which require connections to external equipment, and/or a complete step by step description of the control action of the equipment being submitted. In the event that any questions arise as to the type of information to be presented on the submittal, the supplier shall direct inquiries to the Engineer through the Prime Contractor in advance of the preparation of his/her submittal.

60-11 SUBSTITUTE ITEMS. If in the Design Engineer's sole judgment an item of material or equipment proposed by the Contractor does not qualify as an "or-equal" item, it will be considered a substitute item. The Contractor shall submit sufficient information as provided below to allow the Design Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. The procedure for review by the Design Engineer will include the following and as the Design Engineer may decide is appropriate under the circumstances. Requests for review of substitute items of material or equipment will not be accepted by the Engineer from anyone other than the Contractor. If the Contractor wishes to furnish or use a substitute item of material or equipment, the Contractor shall first make a written application through the Engineer to the Design Engineer for acceptance thereof, certifying that the substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the substitute will prejudice the Contractor's achievement of completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents or Contract Drawings (or in the provisions of any other direct contract with the Owner for work on the Project) to adapt the design to the substitute and whether or not incorporation or use of the substitute in connection with the work is subject to payment of any license fee or royalty. If the substitute item requires modifications to any existing features or to any proposed work, the application shall also include details of proposed modifications necessary to accommodate the substitute item. Such details shall include scaled layouts, dimensions and other pertinent information to enable the Design Engineer to accurately assess the entire application. If the substitute item and proposed modifications are approved, the Contractor, at no additional cost to the Owner, shall do all work necessary to make such modifications and absorb all costs of any related changes imposed on other Contractor's. All variations of the substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by the Design Engineer in evaluating the substitute. The Design Engineer may require the Contractor to furnish additional data about the substitute.

A. Design Engineer's Evaluation. The Design Engineer will be the sole judge of acceptability. No substitute will be ordered, installed or utilized without the Design Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. The Design Engineer will record time required by the Design Engineer and the Design Engineer's Consultants in evaluating substitutes proposed or submitted by the Contractor and in making changes in the Contract Documents or Contract Drawings (or in the provisions of any other direct

contract with Owner for work on the Project) occasioned thereby. The Design Engineer's charges shall be at the same rates the Design Engineer charges for such services to the Owner.

B. Contractor's Expense. All data to be provided by the Contractor in support of any substitute item will be at the Contractor's expense. In order to aid the Design Engineer in determining the equality of an or substitute item (when compared to the item actually specified), the Contractor shall arrange for the performance of any tests requested by the Design Engineer. The Design Engineer shall determine the nature, extent, tester and degree of supervision of such tests. Certified test results shall be mailed directly to the Design Engineer for all tests requested. All costs of such tests, including engineering costs, shall be borne by the Contractor. The Owner may require the Contractor to furnish at the Contractor's expense a special performance guarantee or other surety with respect to any substitute. Whether or not the Design Engineer accepts a substitute item so proposed or submitted by the Contractor, the Contractor shall reimburse the Owner for the charges of the Design Engineer and the Design Engineer's Consultants for evaluating each such substitute item. The costs for evaluating substitute items shall be deducted from the Owner's payment to the Contractor.

60-12 SUBMITTAL PROCEDURE. The following procedure has been established for the submittal and processing of shop and setting drawings, working drawings, and catalogue data. Departures from this procedure may result in delay and misunderstandings.

A. All information required for the Design Engineer's review of each particular pay item shall be sent as one submittal to the Engineer. In addition, if the pay item interfaces with other pay items (as in the case of electrical equipment), then the submittals covering the interfacing pay items shall be sent at the same time.

B. In submitting certifications, drawings, catalog data, and similar items for review, one (1) electronic copy shall be submitted via e-mail. One (1) electronic copy will be returned to the Contractor via e-mail and bearing the review stamp. The Contractor shall provide one (1) hard copy of each submittal for inclusion in the O&M Manual prior to contract closeout. The Contractor shall establish alternative means for electronic transfer of documents for items larger than 5MB.

The Engineer shall be responsible for printing sufficient copies of each submittal for their own records. The Contractor shall be responsible for printing sufficient copies of each submittal for their own records and distributing to each of the other prime or subcontractors whose work is to be correlated with such submittals.

C. For transmitting data for review, one (1) electronic copy shall be submitted via e-mail. The Contractor shall establish alternative means for electronic transfer of documents for items larger than 5MB.

D. Unless otherwise requested, a single copy of the correspondence emanating from the Design Engineer's office will be sent.

E. Submittals will be stamped by the Design Engineer as follows:

1. "Approved", if no change or rejection is made.

2. "Approved as Noted", if minor changes or additions are made, but re-submittal is not considered necessary. All copies will bear the corrective marks.

3. "Revise and Resubmit", if the changes requested are extensive. In this case, re-submittal after correction is necessary and the same number of copies shall be included in the re-submittal as in the first submittal.

4. "Rejected", if it is considered that the data submitted cannot with reasonable revision meet the requirements of the Plans and Specifications.

5. "Submit Specified Item", if the data submitted is not clear, complete, or for other reasons cannot be examined by the Engineer to establish compliance with the Plans and Specifications.

F. Unless otherwise approved in specific cases, all submittals must be transmitted by the Prime Contractor, not by the Subcontractors or vendors.

Any changes in re-submittals, other than those indicated as requested, must be specifically brought to the attention of the Design Engineer. Changes or additions shall not be made in, or to, any fabricated item, part or material without having a re-review.

Submittal Cover Sheet *

Date: _____

From: _____ **Attn:** _____

Company: _____ **Company:** C&S Engineers, Inc.

Phone #: _____ **Phone #:** (877) 277-6583

Email: _____ **Email:** _____

Project Name: _____

Project No.: _____

Reference: Tech. Spec.: _____ Pay Item: _____

Other: _____

Description: _____

_____

Supplier: _____

Manufacturer: _____

Item Type: _____ Catalog Data _____ Manufacturer Certification

_____ Shop Drawings _____ Samples

_____ Other: _____

Contractor's Review:

_____ Reviewed for general compliance of specifications.

_____ This submittal is a ***substitute*** to the specified product.

_____ For Architects / Engineers Approval

This is our _____ submittal for this item.

We are submitting _____ copies.

Submitted by: _____

Date:

C&S Engineers, Inc. Review:

☐ (A) Approved

☐ (A/N) Approved As Noted

☐ (RR) Revise and Resubmit

☐ (REJ) Rejected

☐ (SUB) Submit Specified Item

Checking is only for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the jobsite; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

Reviewed by: _____

Date:

* Note: Provide one cover sheet for each copy of the submittal.

I:\Technical\DisciplineSpecific\Airports\Construction Administration\Shop Drawings\Submittal Cover Sheet.xls

END OF SECTION 60

Section 80 Prosecution 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.

All Subcontractors shall be approved by the Owner prior to being utilized on the project. The Subcontractor shall submit a Subcontractor Approval Request to the Engineer fourteen (14) days prior to beginning work on the project. As a minimum, the information shall include the following:

- Subcontractor's legal company name.
- Subcontractor's legal company address, including County name.
- Principal contact person's name, telephone and fax number.
- Complete narrative description, and dollar value of the work to be performed by the subcontractor.
- Copies of required insurance certificates in accordance with the specifications.
- Minority/ non-minority status.

Should the Contractor elect to assign his/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 case of approval, the Contractor shall file copies of all subcontracts with the Engineer.

The Contractor shall perform, with his organization, an amount of work equal to at least 25 percent of the total contract cost.

80-02 NOTICE TO PROCEED. The notice to proceed will be issued by the Owner and 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 notify the Engineer at least 24 hours in advance of the time actual construction operations will begin.

80-03 PROSECUTION AND PROGRESS. Unless otherwise specified, the Contractor shall submit his/her coordinated construction schedule showing all work activities for the Engineer's approval at least 10 days prior to the start of work. 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.

The schedule shall be prepared as a network diagram in Critical Path Method (CPM), PERT, or other format, or as otherwise specified in the contract for each work area. As a minimum, it shall provide information on the sequence of work activities, start and end dates for each work area, milestone dates, and activity duration. The schedule shall reflect time for delivery of equipment that will impact the schedule as it relates to contract time. The schedule should also include overall project start and end dates.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a bi-weekly 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.

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 his/her operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the prosecution of the work be discontinued for any reason, the Contractor shall notify the Engineer at least 3 days in advance of resuming operations.

The Contractor shall not commence any construction activities prior to the date stated in the notice to proceed.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a bi-weekly 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.

80-04 LIMITATION OF OPERATIONS. The Contractor shall control his/her operations and the operations of his/her subcontractors and all suppliers so as 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/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 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 hereinafter 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:

See Attachment "A" - Construction Safety and Phasing Plan (CSPP) at the end of this section.

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

80-04.1 OPERATIONAL SAFETY ON AIRPORT DURING CONSTRUCTION. All Contractors' operations shall be conducted in accordance with the project Construction Safety and Phasing Plan (CSPP) and the provisions set forth within the current version of Advisory Circular 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 (SPCD) that details how it proposes to comply with the requirements presented within the CSPP. The SPCD can be found in Appendix 3 of the CSPP.

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

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. If the requested changes are acceptable to all the aforementioned parties, the Engineer will request a modification to the CSPP from the FAA. The Contractor shall plan on a minimum of 90 days for this process to be completed. No deviation to the original CSPP shall be made without FAA approval.

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 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 prosecution 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, he 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 he may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the prosecution 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/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. He 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/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/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 work on the items under construction at the time with the normal work force employed on such items. Such days on which the Contractor chooses to engage in work which require the presence of an inspector will be charged against contract time. 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 begin charges against the contract time on the date stated in 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 titled FINAL ACCEPTANCE of Section 50.

(5) The Contractor will be allowed 1 week in which to file a written protest setting forth his/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 is based on the originally estimated quantities as described in the subsection 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 nonwork 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 completed.

If the Contractor finds it impossible for reasons beyond his/her control to complete the work within the contract time as specified, or as extended in accordance with the provisions of this subsection, he may, at any time prior to the expiration of the contract time as extended, make a written request to the Engineer for an extension of time setting forth the reasons which he believes will justify the granting of his/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 which 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 Engineer finds that the work was delayed because of conditions beyond the control and without the fault of the Contractor, he may extend the time for completion in such amount as the conditions justify. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

80-08 FAILURE TO COMPLETE ON TIME. (See the Contract Drawings for Section 80-08 verbiage.)For each partial calendar day or partial 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 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of this Section) the sum of Two Thousand Dollars ($2,000) will be deducted from any money due or to become due the Contractor or his/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 his/her contract.

The work of this Contract and time charged shall commence on the date stated in the written Notice to Proceed. The Contract Time shall be **90 WORKING DAYS** and means that all of the work of the Contract is complete and in operating order.

One day shall be charged against Contract Time for any Working Day on which the Contractor is able to proceed with work for at least six (6) hours toward completion of the Contract. One-half day shall be charged against Contract Time for any Working Day on which the Contractor is able to proceed with work for at least three (3) hours toward completion of the Contract.

The work of this Contract and time charged shall commence on the date stated in the written Notice to Proceed. The time of completion for each work area is shown below, and means that all of the work of the Contract for each work area is complete and in operating order.

The time of completion for each work area shall be included in the overall time to complete the project. Within the time stated in the written Notice Proceed, time shall be charged as follows, and means that all of the work of the Contract for each work area is complete and in operating order:

Work Area A 45 CALENDAR DAYS

Time charged against an individual Work Area shall end when the Engineer deems that work is substantially complete. Substantial completion of work in an individual Work Area is defined as the Work Area being fully operational and open to aircraft traffic, all barricades affecting the Work Area are removed, all temporary jumpers affecting the Work Area are removed, all pavements in the Work Area are cleaned, and NOTAMS affecting the completed Work Area are cancelled.

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 wavier on the part of the Owner of any of its rights under the contract.

80-09 DEFAULT AND TERMINATION OF CONTRACT.

1. The Contractor shall be considered in default of his/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 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 prosecution 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 him 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.

2. Should the Engineer consider the Contractor in default of the contract for any reason hereinbefore, he 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.

3. 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 prosecution 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.

4. Termination of Contract:

a. The Owner may, by written notice, terminate this contract in whole or in part at any time, either for the Owner's convenience or because of failure to fulfill the contract obligations. Upon receipt of such notice services shall be immediately discontinued (unless the notice directs otherwise) and all materials as may have been accumulated in performing this contract, whether completed or in progress, delivered to the Owner.

b. If the termination is for the convenience of the Owner, an equitable adjustment in the contract price shall be made, but no amount shall be allowed for anticipated profit on unperformed services.

c. If the termination is due to failure to fulfill the contractor's obligations, the Owner may take over the work and prosecute the same to completion by contract or otherwise. In such case, the contractor shall be liable to the Owner for any additional cost occasioned to the Owner thereby.

d. If, after notice of termination for failure to fulfill contract obligations, it is determined that the contractor had not so failed, the termination shall be deemed to have been effected for the convenience of the Owner. In such event, adjustment in the contract price shall be made as provided in paragraph b of this clause.

e. The rights and remedies of the Owner provided in this clause are in addition to any other rights and remedies provided by law or under this contract.

5. 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 prosecution 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/her responsibilities for the completed work nor shall it relieve his/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/her work in such a manner as to insure safety and a minimum of hindrance to flight operations. During the work of this Contract, the Owner will make such arrangements to coordinate aircraft movements and Airport operations as necessary to conform to the construction procedures outlined in the Construction Safety and Phasing Plan, and as shown on the Contract Drawings. The Contractor shall give adequate notice to the Engineer, so as to afford time to coordinate construction with the Owner. All Contractor equipment and material stockpiles shall be stored at locations determined during construction such that they do not interfere with an active runway or taxiway. No equipment will be allowed to park within the approach area of an active runway at any time.

See Attachment "A"- Construction Safety and Phasing Plan (CSPP) following this section.

END OF SECTION 80

ATTACHMENT "A"
TO

SECTION 80

CONSTRUCTION SAFETY AND PHASING PLAN (CSPP)

FOR THE CONSTRUCTION OF

APPLE VALLEY AIRPORT TAXIWAY REHAB PROJECT

AT

APPLE VALLEY AIRPORT

COUNTY PROJECT NO.: 10.10.0060

OCTOBER 2023

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APPENDICES:

CONSTRUCTION SAFETY AND PHASING PLAN (CSPP)

1.0 PURPOSE.

Aviation safety is the primary consideration at airports, especially during construction. The airport owner's Construction Safety and Phasing Plan (CSPP) and the contractor's Safety Plan Compliance Document (SPCD) are the primary tools to ensure safety compliance when coordinating construction activities with airport operations. These documents identify all aspects of the construction project that pose a potential safety hazard to airport operations and outline respective mitigation procedures for each hazard.

The CSPP sets forth benchmarks and requirements for the project to help ensure the highest levels of safety, security and efficiency at the airport at the time of construction. Requirements for this CSPP were developed from FAA Advisory Circular (AC) 150/5370-2 Operational Safety on Airports During Construction, latest edition.

The CSPP is a standalone document, written to correspond with the safety and security requirements set forth in the AC, the airport safety and security requirements, and local codes and requirements. The CSPP is to be used by all personnel involved in the project. The CSPP covers the actions of not only the construction personnel and equipment, but also the action of inspection personnel and airport staff.

This document has been developed in order to minimize interruptions to airport operations, reduce construction costs, and maximize the performance and safety of construction activity. Strict adherence to the provisions of the CSPP by all personnel assigned to or visiting the construction site is mandatory.

The Contractor shall submit a Safety Plan Compliance Document (SPCD) to the airport owner describing how the Contractor will comply with the requirements set forth in this CSPP. The SPCD must be submitted to the airport owner with the Proposal. **See Appendix 4**.

In the event the Contractor's activities are found in non-compliance with the provisions of the CSPP or the SPCD, the Airport Owner's Representative will direct the Contractor, in writing, to immediately cease those operations in violation. In addition, a safety meeting will be conducted for the purpose of reviewing those provisions in the CSPP/SPCD which were violated. The Contractor will not be allowed to resume any construction operations until conclusion of the safety meeting and all corrective actions have been implemented.

2.0 SCOPE OF PROJECT AND CSPP.

All work required under this CSPP shall be paid for under Item C-100 Contractor Quality Control Program. The proposed project generally includes reconstruction of the widening of the northern taxilane near Midfield Aviation to comply with Federal Aviation Administration (FAA) standards.

Safety, maintaining aircraft operations, and construction costs are all interrelated. Since safety must not be compromised, the airport owner must strike a balance between maintaining aircraft operations and construction costs. This balance will vary widely depending on the operational needs and resources of the airport and will require early coordination with airport users and the FAA. As the project design progresses, the necessary construction locations, activities and associated costs will be identified. As they are identified, their impact to airport operations must be assessed. Adjustments are made to the proposed construction activities, often by phasing the project and/or to airport operations in order to maintain operational safety. This planning effort will ultimately result in a project CSPP. The development of the CSPP takes place through the following five steps:

1. Identify Affected Areas
2. Describe Current Operations
3. Allow for Temporary Changes to Operations

4. Take Required Measures to Revise Operations
5. Manage Safety Risk

3.0 PLAN REQUIREMENTS.

3.1 COORDINATION. The following items shall be coordinated as required:

a. Emergency Contact Information

EMERGENCY TELEPHONE NUMBER

9-1-1

FOR

√POLICE √FIRE √RESCUE

INFORMATION, COMPLIANCE, AND ASSISTANCE

MAUREEN SNELGROVE ASSISTANT DIRECTOR (909)-387-8810

ADDITIONAL INFORMATION, CONTACTS

C&S COMPANIES, INC. (619) 296-9373 (MON-FRI, 8:00 AM TO 5:00 PM)

KENNETH GETHERS PROJECT MANAGER (619) 819-2279

b. Pre-construction Meeting. A preconstruction meeting will be conducted to discuss operational safety, testing, quality control, quality acceptance, security, safety, labor requirements, environmental factors, and

other issues. All parties affected by the construction will be asked to attend including, but not limited to, the airport owner, tenants, contractor, subcontractors and Engineer.

At the preconstruction meeting, the Contractor shall submit a plan of operation and schedule of work to the Engineer for approval. The Contractor's plan of operation shall indicate, in detail, the amount of construction planned and the number of shifts and/or overtime operations proposed for the project. The schedule of work shall clearly indicate the sequence of work to be performed. The Contractor shall conform, at all times, to the requirements of these provisions and with current safety practices, rules, regulations and security requirements of Airport Owner. The preconstruction meeting will be held prior to issuance of a Notice to Proceed.

c. Contractor Progress Meetings. A minimum of one progress meeting to discuss scheduling and coordination shall be held each week unless otherwise directed by the Airport Owner, throughout the duration of the Contract, between the Airport Owner, Contractor, Engineer and any other interested parties at a time and place to be designated by the Engineer. These meetings shall include a detailed discussion of construction phasing and safety with regard to the Contractor's compliance with the requirements stipulated in the Contract Documents.

In attendance at these meetings shall be a Contractor's representative with the authority to make decisions concerning the scheduling and coordination of work. Progress meetings shall be facilitated by the Engineer. Operational safety shall be a standing agenda item during progress meetings throughout the construction project.

d. Scope or Schedule Changes. Changes in the Scope of Work or Project Schedule shall be governed by Section 40 and Section 80 of the Contract Documents. Any proposed change that results in a deviation from the established CSPP as expressed by the Contract Documents must be submitted to the FAA and Owner for review and approval. FAA review and approval can be expected to take sixty business days.

e. FAA ATO Coordination. Early coordination with Federal Aviation Administration (FAA) Air Traffic Organization (ATO) is required to schedule airway facility shutdowns and restarts. Relocation or adjustments to NAVAIDs, or changes to final grades in critical areas, may require an FAA flight inspection prior to restarting the facility. Flight inspections shall be coordinated and scheduled well in advance of the intended facility restart. Flight inspections shall be as required by technical specifications or special provisions.

f. Pre-Paving Meeting. If paving is included in this project, a pre-paving meeting will be held to discuss the status of preliminary submittals, the Engineer's inspection of the plant and laboratory, test section requirements, paving plan requirements, and production requirements.

g. Payment. The cost of complying with the requirements of this section, including but not limited to scheduling; providing flag people; construction, maintenance and removal of temporary access roads and staging areas; providing, placing, relocating, maintaining and removing temporary barricades; providing and placing permanent barricades; protection of aircraft and vehicular traffic; installation, maintenance and removal of temporary airfield markings; maintenance of airport lighting circuits; installation, maintenance, and removal of temporary wiring and airfield lighting facilities; cleaning of paved surfaces; restoration of surfaces disturbed as a result of the Contractor's operations; providing, maintaining, and removing warning signs, hazard markings, barricade lights; providing, maintaining, and removing temporary access gates; providing padlocks for access gates; providing a guard at access gates; and all security requirements shall be included under Technical Specification Item M-100, Maintenance and Protection of Traffic.

3.2 PHASING.

a. Phase Elements (Work Area(s))

Work Area Descriptions: The work of the project has been divided into (2) work areas in order to coordinate construction in a way that will minimize interference with Airport operations:

Work Area "A". Includes all work associated with the complete demolition and the reconstruction for the widening of the north taxilane. Work is to include but not limited to demolition, earthwork, drainage, base course, paving, lighting, gutters, and re-striping. Portions of Taxiway A will be closed during any work within Work Area "A", as shown in the Contract Drawings.

Work Area "B". Includes all work associated with the complete demolition and the reconstruction of the existing earthen islands located along Taxiway Alpha. Work is to include but not limited to demolition, earthwork, drainage, base course, paving, lighting, and re-striping. Portions of Taxiway A will be closed during any work within Work Area "B", as shown in the Contract Drawings.

b. Construction Work Phasing Requirements

The Contractor shall obtain approval from the Engineer prior to beginning any work in all areas of the airport. No active runway or taxiway shall be crossed, entered, or obstructed at any time, unless it is closed by NOTAM. The Contractor shall plan and coordinate his/her work in such a manner as to insure safety and a minimum of hindrance to airport operations. All Contractor equipment and material stockpiles shall be stored at locations determined during construction or as shown on the Construction Safety Drawings **(Appendix 1)**. No equipment will be allowed to park within the approach area of an active runway at any time. Access to the self-fuel area shall be open to aircraft at all times when the runway is open to traffic.

During the work under this Contract, the Owner will make such arrangements to coordinate aircraft movements and Airport operations as necessary to conform to the construction procedures as outlined below and as shown on the Contract Drawings. The Contractor shall give adequate notice to the Engineer, so as to afford time to coordinate construction with the Owner, per Construction Safety Drawings (**Appendix 1**). No work shall proceed in any area without prior approval.

The Contractor shall always confine construction operations to the contractor work area and designated haul routes. Contractor personnel, equipment, stored materials, subcontractors and suppliers will not be allowed on any other area within the Air Operations Area and within the Airport boundaries without prior approval of the Owner or Engineer.

The Engineer will perform a visual site assessment before the Contractor occupies the contractor work area. The Contractor shall be held responsible for all repairs and cleanup costs incurred as a result of the Contractor's construction operations. Restoration shall be the complete return of all work areas to the original conditions.

Temporary cables in grass areas shall be marked with stakes and flagging. Temporary cables in paved areas shall be marked with barricades.

Prior to the start of construction operations, the Contractor shall perform the following:

- **Prior to the star of work, Contractor shall coordinate with Airport operations a minimum of thirty (30) days in advance of the project starting.**

- Coordinate issuing Notices to Airmen (NOTAM) with the Airport Owner and Engineer for the construction activities involved at least 72 hours in advance of the work.
- Receive permission from Airport Operations to close and Work in work area.
- Place barricades as indicated on the Work Phasing Plans sheet G-102 and G-103 of the Contract Drawings.

At the conclusion of construction operations, the Contractor shall perform the following:

- Test and activate airfield lighting circuits.
- Remove barricades and closed runway markings, as indicated on the Construction Work Phasing Drawing sheets G-102 and G-103 of the Contract Drawings.
- Clean all paved surfaces in accordance with Item M-100, Maintenance and Protection of Traffic.
- Coordinate cancellation of the NOTAMs with the Airport Owner and Engineer.

Work Area "A and B": During work in these areas portions of Taxiway A will be closed to aircraft traffic, as shown on the contract drawings.

At the start of work in Areas A and B, the Contractor shall perform the following:

- Verify with the Owner that a NOTAM has been issued closing portions of Taxiway A as shown on the contract drawings.
- Provide temporary barricades as shown on the contract drawings, sheets G-102 and G-103
- Disconnect the Taxiway A edge lighting circuit in the electrical building.
- Verify with the Owner that a NOTAM has been issued stating that Taxiway A is not lighted.
- Coordinate with Owner as to Tenant access.

At the conclusion of construction operations, the Contractor shall perform the following:

- Test and activate airfield lighting circuits.
- Remove barricades and closed runway markings, as indicated on the Construction Work Phasing Drawing sheets G-102 and G-103 of the Contract Drawings.
- Clean all paved surfaces in accordance with Item M-100, Maintenance and Protection of Traffic.
- Coordinate cancellation of the NOTAMs with the Airport Owner and Engineer.

3.3 AREAS AND OPERATIONS AFFECTED BY THE CONSTRUCTION ACTIVITY.

Contractor, subcontractor, and supplier employees or any other unauthorized persons shall be restricted from entering an active airport operating area without previous permission from the Airport Owner and the Aircraft Control Tower.

In an emergency situation, the Owner or other designated airport representative may order the Contractor to suspend operations; move personnel, equipment, and materials to a safe location; and stand by until aircraft use is completed.

The Contractor shall cooperate with the airport users through the Engineer, in coordination with airport operations, in scheduling the operations to provide adequate clearance for safe aircraft parking, fueling, maintenance, loading or unloading, maneuvering, taxing operations, or other aircraft operations.

Table 3.3A Construction Effect on Airport Operations		
Project	Apple Valley Airport Taxiway Rehab Project	
Phase	Work Area(s) A and B. (See Section 3.2.a for description)	
Scope of Work	Construction of the widening of taxi lane adjacent to Taxiway A	
Operational Requirements	Standard	Anticipated (During Construction)
Runway 18-36 ARC	C-II	Unaffected
RW 18-36 Approach Visibility	Visual/1-mile	Unaffected
RW 18-36	RSA: 500 ft	Unaffected
RW 8-26	OFA: 800 ft	Unaffected
Runway 18-36 Visual NAVAIDS	Beacon, PAPI (18,36) GPS (18), Segmented Circle Wind Indicator	Unaffected.
Runway 18-36 operations	Typical	Back taxi required at 18 end to accommodate partial closure to Taxiway A
Taxiway A	TSA:79 ft	Portions of Taxiway Closed as shown contract drawings
Taxiway A	TOFA:131 ft	Portions of Taxiway Closed as shown on contract drawings

a. Identification of Affected Areas

The following is a summary of impacts to the Airport Operations Areas resulting from the proposed construction and work phasing:

b. Mitigation of effects.

This CSPP has established specific requirements and operational procedures necessary to maintain the safety and efficiency of airport operations during the construction of this project.

All coordination pertaining to airport operations during construction will go through the Owner's Representative and the Airport Operations Manager. Any required NOTAM's to be issued will be sent through the Owner's Representative and issued by Airport Operations.

i. Temporary Changes to runway and/or taxiway operations:
Any affected Airport Operations Areas identified in the previous section for reduced access or identified as being closed entirely to aircraft traffic, will be barricaded by the use of low profile, lighted barricades placed as shown in the exhibits provided in Appendix 1. In addition, required NOTAM's shall be issued on the various temporary changes to aircraft access through the affected areas.

ii. Detours for emergency and other airport vehicles:
The project work site shall remain open to all emergency vehicles in emergency situations. The contractor is required to maintain access in and around the project work area for all

emergency vehicles. Proper routing of this traffic will be effectively communicated to all supervisory personnel involved in the construction project.

iii. Maintenance of essential utilities:

Special attention shall be given to preventing unscheduled interruption of utility services and facilities. Where required due to construction purposes, the Owner and FAA shall locate all of their underground utilities. It is the Contractor's responsibility to have the locations of cabling and other underground utilities marked prior to beginning excavation. Any locations provided by the Owner or FAA are approximate locations and the Contractor shall verify all locations prior to beginning excavations. When an underground cable or utility is damaged due to the Contractor's negligence the Contractor shall immediately repair the affected cable or utility at his/her own expense. Full coordination between airport staff, field inspectors, and construction personnel will be exercised to ensure that all airport power and control cables are fully protected prior to any excavation.

iv. Temporary Changes to air traffic control procedures:

Changes to air traffic control procedures have been coordinated with airport ATO. Any additional requests for changes must be made to the Owner, through the Engineer, in writing. These requested changes will be reviewed by the Engineer, Owner and ATO. If these changes are acceptable to all the aforementioned parties, the Engineer will request a modification to the CSPP previously turned into the FAA. The Contractor shall plan on a minimum 90 days for this process to be completed. No deviation to the original CSPP shall be made without final FAA approval.

3.4 PROTECTION OF NAVIGATIONAL AIDS (NAVAIDS).

Before commencing construction activity, parking vehicles, or storing construction equipment and materials near a NAVAID, coordination with the appropriate FAA ATO to evaluate the effects of construction activity and the required distances and direction from the NAVAID is required.

3.5 CONTRACTOR ACCESS.

This section of the CSPP details the areas to which the contractor must have access, and how contractor personnel will access those project work areas.

a. Location of stockpiled construction materials.

The Contractor shall store material and equipment and schedule his operations for work to be done so that no unauthorized interference to normal Airport operations will result there from. Construction operations shall not be conducted in a manner to cause interference with Airport Operations. Stockpiled materials and equipment storage are not permitted within the Runway Safety Area/ Taxiway Safety Area (RSA/TSA), Obstacle Free Zone (OFZ) or Object Free Area (OFA) of an operational runway or taxiway. Stockpiled construction materials must be located inside the contractor staging area as shown on the Construction Safety Drawings (Appendix 1) unless otherwise approved by the Engineer.

Stockpiled material shall be constrained in a manner to prevent movement resulting from either aircraft jet blast or wind conditions in excess of ten miles per hour. In addition, stockpiled material shall have silt fence located around the material to prevent Foreign Object Debris (FOD) from moving onto the airfield pavements or polluting watercourses.

Open trenches exceeding 3 inches in depth and 5 inches in width or stockpiled material are not permitted within the limits of safety areas of operational runways or taxiways. Stockpiled material shall not be permitted within the protected areas of the runways, or allowed to penetrate into any of the protected airspace.

Spoil and Disposal Areas: Spoil shall be disposed of offsite by the contractor unless otherwise shown or specified. The Contractor shall submit the "Spoils Deposition Release Form" for any spoils which are transported from the project site. A copy of the form can be found in Appendix 4. No direct payment will be made for spoiling and disposal operations. The cost of spoiling material on site, or of spoiling material off-site, shall be considered incidental to this Contract and the costs shall be included in the various pay items involved.

b. Vehicle and pedestrian operations. <u>Vehicle and pedestrian access routes for airport construction projects must be controlled to prevent inadvertent or unauthorized entry of persons, vehicles, or animals onto the Air Operations Area (AOA).</u>

The airport owner will coordinate requirements for vehicle operations with the affected airport tenants. Specific vehicle and pedestrian requirements for this project are as follows:

All construction vehicles and personnel shall be restricted to the immediate work areas specified by the contract for this project. These areas include the haul routes into the work area, the designated contractor staging area and the apron area under construction. Use of alternate haul routes or staging areas by the contractor shall not be permitted without prior notification and approval by the Owner's Representative.

i. Construction Site Parking:

The Contractor's personal vehicle parking area shall be in the contractor staging area, as shown on the Construction Safety Drawings (Appendix 1). Contractor personal vehicles will not be allowed inside the airport fence Air Operations Area (AOA) or secured area.

A staging area, as indicated on the Contract Drawings, will be provided where the Contractor may set up a field office and store equipment and materials. The Contractor shall make his own arrangements for, and bear all costs of required utilities. The Contractor shall use and maintain the site in accordance with requirements of the Owner. Upon completion of work, the Contractor's staging area shall be removed and the area cleaned and restored to original or better condition.

ii. Construction Equipment Parking:

The Contractor's equipment storage area shall be in the contractor staging area as shown on the Construction Safety Drawings (Appendix 1). The Contractor's equipment and construction vehicles shall be restricted to the construction site or storage areas during construction and parked in the equipment storage area during non-working periods. Maximum allowable equipment height in the staging area shall be 25 feet. Maximum allowable equipment height in the work areas shall be 25 feet. Maximum allowable equipment height at the borrow area shall be 25feet.

Contractor must service all construction vehicles within the limits of the project work area or the Contractor's Staging Area. Parked construction vehicles must be outside the OFA and never in the safety area of an active runway or taxiway. Inactive equipment must not be parked on closed taxiways or runways. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be well lighted. Employees shall also park construction

vehicles outside the OFA when not in use by construction personnel (for example, overnight, on weekends, or during other periods when construction is not active). Parking areas must not obstruct the clear line of sight by the ATCT, as applicable, to any taxiways or runways under air traffic control nor obstruct any runway visual aids, signs, or navigation aids.

iii. Access and Haul Roads:

The Contractor shall clear, construct and maintain haul routes as required for the prosecution the work. The haul routes and access points shall only be in the locations approved by the Engineer and the Owner or as shown on the Construction Safety Drawings (Appendix 1).

Access or haul routes used by contractor vehicles must be clearly marked to prevent inadvertent entry to areas open to airport operations. Construction traffic must remain on the designated haul routes, never straying from the approved paths. Haul and access routes shall be clearly delineated with temporary marking and signage by the Contractor. Signage and marking placement shall be reviewed and approved by the Engineer and Owner prior to being put into service. The Contractor shall fully describe the appropriate access routes to all his/her employees, subcontractors and material delivery personnel.

The Contractor shall be responsible for maintaining existing haul routes. At the completion of the project, these areas shall be returned to their original lines and grades and shall be restored to a condition equal to or better than original. All non-paved areas that are disturbed by Contractor's haul roads, staging area, etc., located outside of the seeding limits shown on the plans shall be re-seeded and restored to their original or better condition by the Contractor at no additional cost to the Owner.

The Contractor shall coordinate haul routes, closures and schedules with other projects which may be underway during the same time period as this contract.

The Contractor shall control and coordinate the material (supplies) that are hauled to and from work area. Delivery of equipment and materials to the area of work shall be by way of the access route shown on the Construction Safety Drawings (Appendix 1) or designated by the Owner or Engineer.

The Contractor shall maintain all haul routes and work areas in a dust free condition at all times. The Contractor shall control dust from the construction operations by vacuum type sweeping, watering or other methods as approved by the Engineer. Contractor shall have equipment (in operating condition) on site, at all times, to control dust. If the Contractor fails to comply with this requirement, construction will be suspended until a plan for controlling the dust is approved by the Engineer. Landside haul routes, boulevards and drives shall be kept clean by use of a vacuum sweeper on a daily basis as required. Application of water on dirt or gravel haul routes must be provided as often as necessary. Haul roads in any airport traffic areas must be especially monitored for dust and debris to prevent any potential Foreign Object Debris (FOD) situations.

The existing perimeter road shall remain open and accessible for airport personnel at all times. Special attention must be given to ensure that if construction traffic is to share or cross any emergency first response routes where emergency right of way is not impeded at any time, and that construction traffic on haul roads do not interfere with NAVAIDs or approach surfaces of operational runways.

Portions of the project area(s) shall be bounded by the low profile barricades identifying Contractor personnel and vehicle area operation limits. The locations of any barricaded project

limits, haul routes, Contractor Staging Areas, and associated safety and security details are also provided graphically in the attached exhibits.

iv. Marking and Lighting of Vehicles:

When any vehicle or piece of equipment, other than one that has prior approval from the Owner, must operate on an airport, it shall be escorted and properly identified.

The Contractor shall limit access within the airport security fence to authorized vehicles. All authorized vehicles shall have a vehicle dash board placard permit issued by the Owner or an identification sign on both sides of the vehicle containing the Contractor's company name. Private vehicles of the Contractor's personnel must be parked outside the airport security fence and will not be allowed within the airport security fence at any time.

All vehicles operating on the airport and in the general vicinity of the safety area or in aircraft movement areas must be marked with flashing yellow/amber beacons or orange and white flags during daylight hours. During hours of darkness or low visibility they shall be marked with at least flashing yellow/amber beacons. Beacons and flags must be maintained to standards and in good working and operational condition. Beacons must be located on the uppermost part of the vehicle structure, visible from any direction, and flash 75 +/- 15 flashes per minute. Flags shall be 3' by 3' with alternating 1' by 1' international orange and white squares, and shall be replaced by the contractor if they become faded, discolored, or ragged as determined by Airport Operations or the Owner's Representative.

v. Description of Proper Vehicle Operations:

The Contractor shall be required to follow guidance on the additional identification and control of construction equipment per the Airport's Security Plan. No Contractor's vehicle or pedestrian crossing of active runways or taxiways will be allowed at any time during the work of this Contract, unless otherwise specified. No deviation from the pedestrian and vehicle routes to and from the Project Areas will be allowed unless specific permission has been granted by the Owner.

The ground movement of aircraft shall have the right-of-way at all times, and the Contractor's vehicles and equipment shall yield to aircraft at all times.

vi. Required Escorts:

Anyone not in possession of a current airport badge shall be escorted by an appropriately badged person. At no time will vehicles or personnel enter portions of the secure AOA outside the contract area unless permitted and accompanied by an airport approved escort.

All construction-related activity taking place within any airport defined movement area requires the presence of an authorized Airport escort having radio communication with the FAA control tower or UNICOM unless prior approval is obtained from Airport Operations. Spotters and/or flaggers having radio or telephone contact with the Airport may be used with the approval of the on shift Airport Operations Manager.

At no time shall active taxiways or taxilanes be crossed by construction equipment without notification and proper approval/clearance from radio-trained gate guards or Airport Operations.

vii. Training Requirements for Vehicle Drivers:

Any employees the Contractor would request to be given permission by Airport Operations to drive on the AOA shall complete airport badging and driver training per the Airport's requirements. These employees then must have an airfield driving experience with Airport Operations and if Airport Operations is satisfied of the employee's competency, that employee may be granted permission from Airport Operations to drive on the AOA. Passing the AOA driver training does not given the Contractor's employees the ability to drive on the AOA.

viii. Situational Awareness:

Aircraft traffic will continue to use existing runways, aprons, and taxiways of the Airport during the time that work under a contract is being performed. The Contractor shall, at all time, conduct the work as to create no hindrance, hazard, or obstacle to aircraft using the Airport.

Vehicle drivers must confirm by personnel observation that no aircraft is approaching their position (either in the air or on the ground) when given clearance to cross a runway, taxiway, or any other area open to airport operations. In addition, it is the responsibility of the escort vehicle driver to verify the movement/position of all escorted vehicles at any given time.

ix. Two-way Radio Communication Procedures:

The Contractor shall comply with proper radio usage, including read back requirements and proper phraseology including the International Phonetic Alphabet.

Even though radio communication is maintained, escort vehicle drivers must also familiarize themselves with ATCT light gun signals in the event of radio failure. See the FAA safety placard "Ground Vehicle Guide to Airport Signs and Markings." This safety placard may be downloaded through the Runway Safety Program Web site at http://www.faa.gov/airports/runway_safety/publications/ (See "Signs & Markings Vehicle Dashboard Sticker".) or obtained from the FAA Airports Regional Office.

x. Maintenance of the Secured Area of the Airport.

Airport owner and contractors must also maintain a high level of security during construction when access points are created in the security fencing to permit construction vehicle access. Temporary gates shall be equipped and/or manned by construction personnel to prevent unauthorized access by vehicles, animals or people. Procedures conforming to Airport security protocols should be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit "piggybacking" behind another person or vehicle. Access shall be made available at all times to all airport emergency vehicles traveling to operations areas within the proximity of the construction work zone.

c. Security.

Each Contractor's employee, subcontractors and their employees will be issued an identification card by the Owner to permit access to secured area. Contractors will be charged two dollars ($2.00) for each card and they shall include the price of this in their bid. Cards shall be returned at the end of the project. In general, security in the construction area is the responsibility of the Contractor.

The Contractor shall be responsible for maintaining security at all access gates used during the project and will be held liable by the Owner for any breach of security. No gate shall be left open. The Contractor shall be required to post a guard at the gate to open and close the gate for personnel and equipment. No gate shall be left open. Guard shall be responsible for ensuring that no unauthorized persons or vehicles enter the secure area. Airport owner and contractors must take care to maintain security during construction when access points are created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates shall be equipped so they can be securely closed and locked to prevent access by animals and unauthorized people. Procedures should be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit "piggybacking" behind another person or vehicle.

The Contractor shall be required to maintain security and comply with the Airport Security Plan and the Transportation Security Administration Security Rules and Regulations throughout the duration of the project. The Contractor and the Surety shall indemnify and save harmless the Owner, Engineer and third party or political subdivision from any and all breaches of security and shall indemnify the Owner for any fines, expenses and damages which it may be obliged to pay by reason of any breach of security resulting from the Contractor's actions at any time during the prosecution of the work. Such breaches of security are subject to fines by the Transportation Security Administration of up to ten thousand dollars ($10,000) per incident.

3.6 WILDLIFE MANAGEMENT.

Construction contractors must carefully control and continuously remove waste or loose materials that might attract wildlife. Contractor personnel must be aware of and avoid construction activities that can create wildlife hazards on airports.

a. Trash. Food scraps from construction personnel activity must be collected and disposed of at a proper facility.

b. Standing water. Water shall not be allowed to collect and pool for more than any single 24-hour period. Temporary grading may be required to promote drainage during daily operations as well as between work phases.

c. Tall grass and seeds. The use of millet seed in turfing and seeding operations shall not be permitted.

d. Poorly maintained fencing and gates. The Contractor shall maintain a constant secure perimeter to the airfield, including continuous security perimeter fencing and gates (if applicable).

e. Disruption of existing wildlife habitat. Not applicable to this project.

Contractor shall take immediate remedial action to remove wildlife attractants should any occurrence be noted. Contractor shall immediately report to the Engineer and Owner should any wildlife congregation be noted, and in particular if mammals enter the airport through the construction gate.

3.7 FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT.

Special care and measures shall be taken to prevent Foreign Object Debris (FOD) damage when working in an airport environment. Waste and loose materials, commonly referred to as FOD, are capable of causing damage to aircraft landing gears, propellers, and jet engines. The Contractor shall be responsible for implementing an approved FOD Management Plan prior to the start of construction activities. The FOD

Management Plan will have procedures for prevention, regular cleanup, and containment of construction material and debris. The Contractor will ensure all vehicles related to the construction project using paved surfaces in the AOA shall be free of any debris that could create a FOD hazard. Special attention will be given to the cleaning of cracks and pavement joints. All taxiways, aprons, and runways must remain clean. Waste containers with attached lids shall be required on construction sites.

Special attention should be given to securing lightweight construction material (concrete insulating blankets, tarps, insulation, etc.). Specific securing procedures and/or chain link enclosures may be required.

Contractors will provide their own equipment for vehicle and equipment washing and clean up.

Immediate access to a power sweeper is required when construction occurs on any pavement area inside the AOA, unless an appropriate alternative has been approved by the Owner's Representative and Airport Operations Manager.

3.8 HAZARDOUS MATERIALS (HAZMAT) MANAGEMENT.

Contractors operating construction vehicles and equipment on the airport must be prepared to expeditiously contain and clean-up spills resulting from fuel, hydraulic fluid, or other chemical fluid leaks. Transport and handling of other hazardous materials on an airport also requires special procedures. To that end, the Contractor is required to develop a spill prevention plan and response procedures for vehicle operations prior to the start of construction activities. This includes maintenance of appropriate MSDS data and appropriate prevention and response equipment on-site.

Fueling Procedures and Spill Recovery Procedures shall be in accordance with Fire Code, latest edition, and the National Fire Protection Association standard procedures for spill response, latest edition. If fueling is to take place in the staging area, it must be away from catch basins. Contractor must have spill containment kits on site.

In the event of a fuel spill or the spill of other hazardous materials, the Contractor shall immediately notify the Owner and the Engineer, the Environmental Protection Agency, the Owner and the Engineer.

Contractor shall abide by the specific requirements contained in the Technical Specifications of this contract.

3.9 NOTIFICATION OF CONSTRUCTION ACTIVITY.

The following is information and procedures for immediate notification of airport users and the FAA of any conditions adversely affecting the operational safety of the airport.

a. Maintenance of a list of Responsible Representatives/ Point of contact. A list of responsible representatives and points of contact shall be created by the Engineer, the Airport and the Contractor prior to the start of construction. This list shall be compiled as part of the project pre-construction meeting agenda. Procedures will be established to contact all parties, including after regular work hours. Updates will be made to the list throughout the project duration by the Engineer. Contractor points of contact shall be incorporated into the contractor's SPCD.

b. Notices to Airman (NOTAM). Only the airport owner may initiate or cancel NOTAMs on airport conditions, and is the only entity that can close or open a runway or taxiway. The airport owner must coordinate the issuance, maintenance, and cancellation of NOTAMs about airport conditions resulting from construction activities with tenants and the local air traffic facility (control tower, approach control, or air traffic control center), and must provide information on closed or hazardous conditions on airport

movement areas to the FAA Flight Service Station (FSS) so it can issue a NOTAM. The airport owner must file and maintain a list of authorized representatives with the FSS. Only the FAA may issue or cancel NOTAMs on shutdown or irregular operation of FAA owned facilities. Any person having reason to believe that a NOTAM is missing, incomplete, or inaccurate must notify the airport owner. See Section 3.14 regarding issuing NOTAMs for partially closed runways versus runways with displaced thresholds.

Any NOTAMs for planned airfield closures for this project must be coordinated through the airport manager and the airports duly appointed construction management representative. Reference Section 3.2 for planned closures for this project, which require issuance of a NOTAM.

c. Emergency Notification Procedures. In the event of an aircraft emergency, severe weather conditions, or any issue as determined by the Airport that may affect aircraft operations, the Contractor's personnel and/or equipment may be required to immediately vacate the area(s) affected. Points of contact for the various parties involved with the project shall be identified and shared at the pre-construction meeting among the various parties. Emergency points of contact shall be incorporated into the contractor's SPCD.

d. Accidents. The Contractor shall provide at the site such equipment and medical facilities as are necessary to supply first aid service to anyone who may be injured in connection with the work. The Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance for the work, whether on or adjacent to the site which caused death, personal injury or property damages, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Engineer and the Owner.

If any claim is made by anyone against the Contractor or any Subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer giving full details of the claims.

e. Coordination with First Response Personnel. The contractor shall coordinate, through the duly appointed airport representative, with first response emergency personnel, mutual aid providers and other emergency services if construction requires the following:

- The deactivation and subsequent reactivation of water lines or fire hydrants, or
- The re-routing, blocking and restoration of emergency access routes, or
- The use of hazardous materials on the airfield.

Procedures and methods for addressing any planned or emergency response actions on the airfield concerning this project shall be established and implemented prior to the start of construction.

f. Notification to the FAA.

i. Part 77. Any person proposing construction or alteration of objects that affect navigable airspace, as defined in Part 77, must notify the FAA. This includes construction equipment and proposed parking areas for this equipment (i.e. cranes, graders, other equipment) on airports. FAA Form 7460-1, Notice of Proposed Construction or Alteration, is used for this purpose and submitted to the appropriated FAA Airports Regional or District Office. A 7460-1 form for this project has been completed and submitted by the Airport Owner for using equipment with a maximum height of x feet. A new 7460-1 form must be submitted to the FAA for review and comment for any equipment which the Contractor will use which is taller than the equipment used in the above 7460-1 submission. The Owner will be responsible for submitting the new 7460-1 form to the FAA. To that end, the Contractor shall identify the equipment in his SPCD ,including the maximum height it will

extended to during construction, the area(s) in which the equipment will be used, and the duration the equipment will be used

ii. **Part 157.** It is not anticipated that Part 157 notifications will be required for this project.

iii. **NAVAIDS.** For emergency (short-notice) notification about impacts to both airport owned and FAA owned NAVAIDs, contact: 866-432-2622.

3.10 INSPECTION REQUIREMENTS.

a. Daily (or more frequent) inspections. Inspections shall be conducted by the Contractor at least daily, but more frequently if necessary, to ensure conformance with the CSPP. A sample checklist is provided in Appendix 2 of this document. In addition to Contractor's required inspections, airport operations will inspect the construction site three (3) times a day to ensure compliance with the CSPP and the SPCD. The Owner's Representative will have full-time inspectors monitoring activity throughout construction. Promptly take all actions necessary to prevent or remedy any unsafe or potentially unsafe conditions as soon as they are discovered.

b. Final inspections. A final inspection with the Owner's Representative, Airport and Contractor will take place prior to allowing airport operations.

3.11 UNDERGROUND UTILITIES.

Special attention shall be given to preventing unscheduled interruption of utility services and facilities. Where required due to construction purposes, the FAA shall locate all of their underground cables. The Contractor shall locate and/or arrange for the location of all the underground cables. When an underground cable is damaged due to the Contractor's negligence the Contractor shall immediately repair the cable affected at his/her own expense. Full coordination between airport staff, field inspectors, and construction personnel will be exercised to ensure that all airport power and control cables are fully protected prior to any excavation. Locations of cabling will be marked prior to beginning excavation.

Prior to opening an excavation, effort shall be made to determine whether underground installation: i.e., sewer, water, fuel, electric lines, etc., will be encountered, and if so, where such underground installations are located. When the excavation approaches the approximate locations of such an installation, the exact locations shall be determined by careful hand probing or hand digging, and/or use of a vacuum truck, and when it is uncovered, adequate protection shall be provided for the existing installation. All known owners of underground facilities in the area concerned shall be advised of proposed work at least 48 hours prior to the start of actual excavation.

The information concerning underground utilities was compiled from information and sketches furnished by or obtained from utility companies and the Airport. The Owner and the Engineer do not guarantee their accuracy. The Contractor is advised to determine the exact locations from the available sources of information or provide his own means of detection. The only case in which the Engineer will consider redesign or relocation of a proposed facility in the project is when an existing utility is located within the construction limits. In this case, the Engineer will work with the Airport Owner to determine the appropriate action to resolve the conflict. If such relocation is impossible, the Engineer will consider re-design or relocation of the proposed facilities. In both cases, Contractor shall be responsible for all underground utilities and shall not be separately compensated for delays or extra cost.

Note that services do not include locating FAA and Owner facilities.

3.12 PENALTIES.

Failure on the part of the contractor to adhere to prescribed requirements may have consequences that jeopardize the health, safety or lives of customers and employees at the airport. The Airport may issue warnings on the first offense based upon the circumstances of the incident. Individuals involved in non-compliance violations may be required to surrender their Airport ID badges and/or be prohibited from working at the airport, pending an investigation of the matter.

Penalties for violations related to airport safety and security procedures will be established by the Airport.

Note: project shutdown or misdemeanor citations may be issued on a first offense. When construction operations are suspended, activity shall not resume until all deficiencies are rectified.

3.13 SPECIAL CONDITIONS.

In the event of an aircraft emergency, the Contractor's personnel and/or equipment may be required to immediately vacate the area. The Contractor will receive notification from airport operations when special conditions require the construction site to be vacated. In any event, extreme care should be exercised should construction personnel identify any emergency or rescue vehicle moving toward the Runway with emergency lights displayed. This will generally mean that an emergency situation is imminent.

Special conditions that could require suspension of the construction work include the following: aircraft in distress, aircraft accident, security breach, VIP operation, vehicle/pedestrian deviation, severe weather, or failing to abide by this Construction Safety and Phasing Plan and/or the Safety Plan Compliance Document.

3.14 RUNWAY AND TAXIWAY VISUAL AIDS.

This topic includes marking, lighting, signs, and visual NAVAIDs. Those areas where aircraft will be operating shall be clearly and visibly separated from construction areas, including closed runways. Throughout the duration of the construction project, the Contractor shall inspect and verify that these areas remain clearly marked and visible at all times and that marking, lighting, signs and visual NAVAIDs remain in place and operational.

a. General. Airport markings, lighting, signs, and visual NAVAIDs must be clearly visible to pilots, not misleading, confusing, or deceptive. All must be secured in place to prevent movement by prop wash, jet blast, wing vortices, or other wind currents and constructed of materials that would minimize damage to an aircraft in the event of inadvertent contact.

b. Markings. Markings must be in compliance with the standards of AC 150/5340-1, Standards for Airport Markings, current edition, and the drawings and technical specifications of this project.

c. Lighting and visual NAVAIDs. All taxiway edge lights in those sections of taxiways closed to aircraft traffic will be either de-energized or blacked out by use of an appropriately cut length of PVC pipe.

d. Signs. Signs must be in conformance with AC 150/5345-44, Specification for Runway and Taxiway Signs and AC 150/5340-18, Standard for Airport Sign Systems, current edition. Airfield signage will be installed and/or replaced along impacted taxiways and taxilanes.

e. Maintenance of Airport Lighting. All existing airfield lighting circuits shall be maintained in full operation throughout the period of this Contract. Where disconnections are required, such work shall be scheduled at such times and in such a manner as approved by the Owner. The Contractor is required to

allow the full use of airfield lighting circuits in open movement areas during night operations and during periods of low visibility. The Contractor shall provide such temporary lights and cables as required to maintain full use of existing airfield lighting circuits. Temporary above ground lighting cables, if approved, shall be delineated with stakes and flagging at the direction of the Engineer.

All circuits in the vicinity of the work area shall be tested prior to, during and after construction. The Contractor shall furnish all necessary equipment and appliances for testing the airport electrical systems and underground cable circuits as specified below. 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 and shall be at the sole expense of the Contractor. For phased projects, the tests must be completed by phase and results meeting the specifications below must be maintained by the Contractor throughout the entire project as well as during the ensuing warranty period.

Earth resistance testing methods shall be submitted to the Engineer for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the Engineer. All such testing shall be at the sole expense of the Contractor.

Should 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.

The test equipment for insulation resistance shall be an insulation resistance tester (1,000V megger) with a digital readout. The instrument shall provide a 500 volt test for insulation resistance with a meter range of 0 to 500 megohms. The Contractor shall test, demonstrate and record to the satisfaction of the Engineer the following:

a. Test Requirements Prior to Construction.

   (1) Test all circuits within the work area for continuity and insulation resistance to ground, at the electrical building, in the presence of the Engineer and the Owner.

   (2) Provide a copy of the test results to the Engineer and the Owner.

   (3) Check that all circuits are properly connected in accordance with applicable wiring diagrams.

b. Test Requirements During Construction. Circuit testing during construction shall be as directed and witnessed by the Engineer when the Contractor is working on existing circuitry or excavating adjacent to or near existing circuitry. Circuit testing during construction will not be required during the times when the Contractor's operations do not effect existing airfield lighting circuitry. It is the intent of this section to ensure that airfield lighting circuitry remains operational throughout the duration of the Contract.

   (1) Test all circuits within the work area for continuity and insulation resistance to ground at the electrical building, prior to energizing any circuit.

   (2) Insure that all circuits within the work area are operational, prior to the Contractor leaving the project at the end of the work day. Specific times for circuit checks will be determined by the Engineer relative to the Contractor's work hours each day.

(3) Segment test new non-grounded series circuits during installation. Length of cable segment tested shall not have more than five (5) splices, light units and/or electrical equipment between the ends being tested. Insulation resistance to ground shall be not less than 500 megohms.

(4) Insure that the insulation resistance to ground of each segment of new non-grounded conductors of multiple conductor circuits is not less than 500 megohms.

(5) That the impedance to ground of each ground rod does not exceed 25 ohms prior to establishing connections to other ground electrodes or equipment. The fall-of-potential ground impedance test shall be utilized, as described by ANSI/IEEE Standard 81, to verify this requirement. Ground rods testing higher than 25 ohms shall have a minimum extension of two feet of ground rod added, driven to the proper elevation and re-tested. Extensions shall be attached by exothermic methods and re-testing performed until the tests show 25 ohms resistance or less. Tests shall not be performed within 72 hours after a rain storm has ended or when standing water is present around the ground rod.

(6) Insure that all circuits are properly connected in accordance with applicable wiring diagrams.

(7) The Contractor shall test all circuits within the work area for continuity after backfilling cable trenches. The reading shall be logged and provided to the Engineer prior to payment of cable items.

(8) Provide a copy of all test results to Engineer and Owner on a daily basis.

c. Test Requirements at the Completion of the Project. The Contractor shall test and demonstrate to the satisfaction of the Engineer the following:

(1) Test all circuits within the work area for continuity and insulation resistance to ground, at the electrical building, in the presence of the Engineer and the Owner.

(2) That all original lighting power and control circuits are continuous and insulation resistance to ground is not lower than before construction.

(3) That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.

(4) That all affected circuits (existing and new) are free from unspecified grounds.

(5) That the insulation resistance to ground of all new non-grounded series circuits or cable segments is not less than 50 megohms.

(6) That the insulation resistance to ground of all non-grounded conductors of new multiple circuits or circuit segments is not less than 50 megohms.

(7) That all affected circuits (existing and new) are properly connected in accordance with applicable wiring diagrams.

(8) 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.

The Contractor shall be responsible for maintaining an insulation resistance of 50 megohms minimum, with isolation transformers connected, in new circuits and new segments of existing circuits through the end of the contract warranty period.

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.

3.15 MARKING AND SIGNS FOR ACCESS ROUTES.

Location of haul routes on the airport site shall be as specified in the project drawing set and as provided graphically in the attached exhibits, reference Appendix 1. It shall be the Contractor's responsibility to coordinate off-site haul routes with the appropriate owner who has jurisdiction over the affected route. The haul routes, to the extent possible, shall be marked and signed in accordance with FAA airfield signage requirements, the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or state highway specifications, as applicable.

3.16 HAZARD MARKING AND LIGHTING.

a. Purpose. Hazard marking and lighting prevents pilots from entering areas closed to aircraft, and prevents construction personnel from entering areas open to aircraft. To that end, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles shall be installed and maintained by the Contractor for the duration of construction operations.

b. Equipment. Low Profile Barricades of the type detailed in the project drawings with red omnidirectional flashing lights shall be placed outside the safety area of intersecting taxiways at the edge of the closed airfield surfaces and the project work limits. Layout locations for this equipment are as shown on the Construction Work Phasing Drawings and attached exhibits, reference Appendix 1.

Plastic Drum Type Barricades of the type detailed in the project drawings with omnidirectional flashing lights shall be placed. Layout locations for this equipment are as shown on the Construction Work Phasing Drawings and attached exhibits, reference Appendix 1.

The Contractor shall have a person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. The Contractor must file the contact person's information with the airport owner. Lighting should be checked for proper operation at least once per day, preferably at dusk.

3.17 PROTECTION OF AIRFIELD AREAS.

Safety area encroachments, improper ground vehicle operations and unmarked or uncovered holes and trenches in the vicinity of aircraft operation surfaces and construction areas are the three most recurring threats to safety during construction. Protection of runway and taxiway safety areas, object free areas, obstacle free zones, and approach/departure surfaces shall be a standing requirement for the duration of construction operations.

a. Runway Safety Area (RSA). A runway safety area is the 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 by aircraft.

Runway	Aircraft Design Group	RSA Distance from Centerline RSA	Holdline	RSA Width	RSA Length from End of Runway
18-36	C-II	250 ft.	250 ft.	500 ft.	1000 ft.
8-26	B-I	60 ft	60 ft	120 ft	240 ft

No construction may occur within the existing RSA while the runway is open. Any construction between RSA and Holdline must be approved with Airport Operations prior to starting work.

The airport owner must coordinate any adjustment of RSA dimensions, to meet the above requirement, with the appropriate FAA Airports Regional or District Office and the local FAA air traffic manager and issue a NOTAM.

Open trenches or excavations are not permitted within the RSA while the runway is open. The Contractor must backfill trenches before the runway is opened. Coverings are not allowed in runway safety areas. There shall be no stockpiled materials or equipment stored within the limits of the RSA.

After the Runway has been closed, Contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport owner, and light them with red lights during hours of restricted visibility or darkness.

Soil erosion must be controlled to maintain RSA standards, that is, the RSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

b. Runway Object Free Area (ROFA). Construction, including excavations, may be permitted in the ROFA. However, equipment must be removed from the ROFA when not in use, and material should not be stockpiled in the ROFA if not necessary. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval.

Runway	Aircraft Design Group	ROFA Distance from Centerline	ROFA Width	ROFA Length from End of Runway
18-36	C-II	400 ft	800 ft.	100 ft.
8-26	B-I	200 ft	400 ft	240 ft

c. Taxiway Safety Area (TSA). The taxiway safety area is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. No construction may occur within the TSA while the taxiway is open for aircraft operations.

Taxiway	Aircraft Design Group	TSA Distance from Centerline	TSA Width
All	C-II	39.5 ft.	79 ft.

Open trenches or excavations are not permitted within the TSA while the taxiway is open. The Contractor must backfill trenches before the taxiway is opened. Coverings are not allowed in taxiway safety areas.

The airport owner must coordinate any adjustment of TSA dimensions, to meet the above requirement, with the appropriate FAA Airports Regional or District Office and the local FAA air traffic manager and issue a NOTAM.

After the Taxiway has been closed, Contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport owner, and light them with red lights during hours of restricted visibility or darkness.

Soil erosion must be controlled to maintain TSA standards, that is, the TSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

d. Taxiway Object Free Area (TOFA). Unlike the Runway Object Free Area, aircraft wings regularly penetrate the taxiway/taxilane object free area during normal operations. Thus the restrictions are more stringent. No construction equipment may be parked within the TOFA while the taxiway/taxilane is open for aircraft operations.

Construction activity may be accomplished without adjusting the width of the taxiway object free area, subject to the following restrictions:

(i) Appropriate NOTAMs are issued.

(ii) Marking and lighting meeting the provisions above are implemented.

(iii) Five-foot clearance is maintained between equipment and materials and any part of an aircraft (includes wingtip overhang). In these situations, flaggers must be used to direct construction equipment, and wing walkers will be necessary to guide aircraft. Wing walkers should be airline/aviation personnel rather than construction workers. 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 the passage of that aircraft.

Taxiway	Aircraft Design Group	TOFA Distance from Centerline	TOFA Width
All	C-II	65.5 ft.	131 ft.

Taxilane	Aircraft Design Group	TLOFA Distance from Centerline	TLOFA Width
All	C-II	57.5 ft.	115 ft.

e. Obstacle Free Zone (OFZ). Construction personnel, material, and/or equipment may not penetrate the OFZ while the runway is open for aircraft operations. The OFZ is a defined volume of airspace centered about and above the runway centerline.

f. Runway approach/departure surfaces. All personnel, materials, and/or equipment must remain clear of the applicable threshold siting surfaces. Objects that do not penetrate these surfaces may still be obstructions to air navigation and may affect standard instrument approach procedures. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

Construction activity in a runway approach/departure area may result in the need to partially close a runway or displace the existing runway threshold. Partial runway closure, displacement of the runway threshold, as well as closure of the complete runway and other portions of the movement area also require coordination through the airport owner with the appropriate FAA air traffic manager (FSS if non-towered) and ATO/Technical Operations (for affected NAVAIDS) and airport users.

Runway End	Aircraft Approach Category	Airplane Design Group	Minimum Safety Area Behind Threshold	Minimum Unobstructed Approach Slope
18	C	II	500	34:1 to 200 feet behind threshold
36	C	II	500	20:1 to 200 feet behind threshold
8, 26	C	II	500	34:1 to 200 feet behind threshold 20:1 to threshold

3.18 OTHER LIMITATIONS ON CONSTRUCTION.

A. Prohibitions. The following prohibitions are in effect for the duration of this project:

1. No use of tall equipment (cranes, concrete pumps, and so on) unless a 7460-1 determination letter is issued for such equipment.
2. No use of open flame welding or torches unless fire safety precautions are provided and the airport owner has approved their use.
3. No use of electrical blasting caps or explosives of any kind on or within 1,000 ft (300 m) of the airport property.
4. No use of flare pots within the AOA.

B. Restrictions.

i. Construction suspension required during specific airport operations – Not Applicable
ii. Areas that cannot be worked on simultaneously – Not Applicable
iii. Day or night construction restrictions – Not Applicable

Equipment for nighttime lighting of construction areas shall be sufficient to adequately illuminate the work area in order to ensure quality construction. The lights shall be positioned to provide the most natural color illumination and contrast with a minimum of shadows. Lighting pavements from both sides is considered preferable as lighting from only one side can result in objectionable shadows. Light towers shall be positioned and adjusted to aim away from ATCT cabs, active runways, and active taxiways to prevent blinding effects. The Contractor shall prepare a plan showing the locations, heights and aiming points of light towers for review by the Owner, Engineer and ATCT personnel. The final location and aiming of light towers shall be determined by trial, therefore, the Contractor must be aware that several attempts at locations and aiming angles may be necessary before the light towers can be operational. Light towers shall be removed from the construction site prior to opening the pavement to aircraft operations.

It is recommended that all equipment, except haul trucks, be equipped with artificial illumination to safely illuminate the area immediately surrounding their location.

Unless provided for elsewhere, the cost of nighttime lighting of construction areas shall be considered a subsidiary and incidental part of construction and as such, the Contractor shall include all costs associated with nighttime lighting of construction areas in the various pay items of work involved.

Where work on this Contract is not scheduled for night work and the Contractor requests and receives permission to work at night, there will be no additional compensation allowed for the extra costs associated with night work.

iv. Seasonal Construction Restrictions – Not Applicable

APPENDIX 1

LOCATION MAP
(Sheet G-001 of the Contract Drawings)

GENERAL PLAN
(Sheet G-101 of the Contract Drawings)

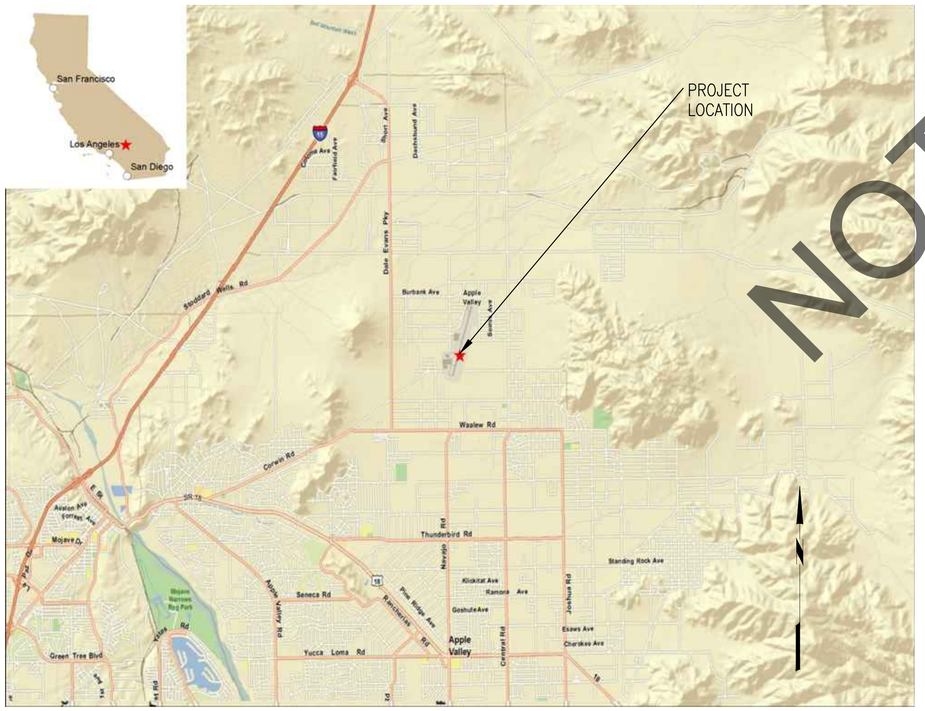
CONSTRUCTION WORK PHASING DRAWINGS
(Sheets G-102 and G-103 of the Contract Drawings)

WORK PHASING DETAILS
(Sheet G-102 of the Contract Drawings)

CONTRACT DRAWINGS
FOR THE CONSTRUCTION OF

APPLE VALLEY AIRPORT TAXIWAY REHAB PROJECT
COUNTY PROJECT: 10.10.0060

APPLE VALLEY AIRPORT
21600 CORWIN ROAD, APPLE VALLEY, CA, 92307
SAN BERNARDINO COUNTY, CALIFORNIA



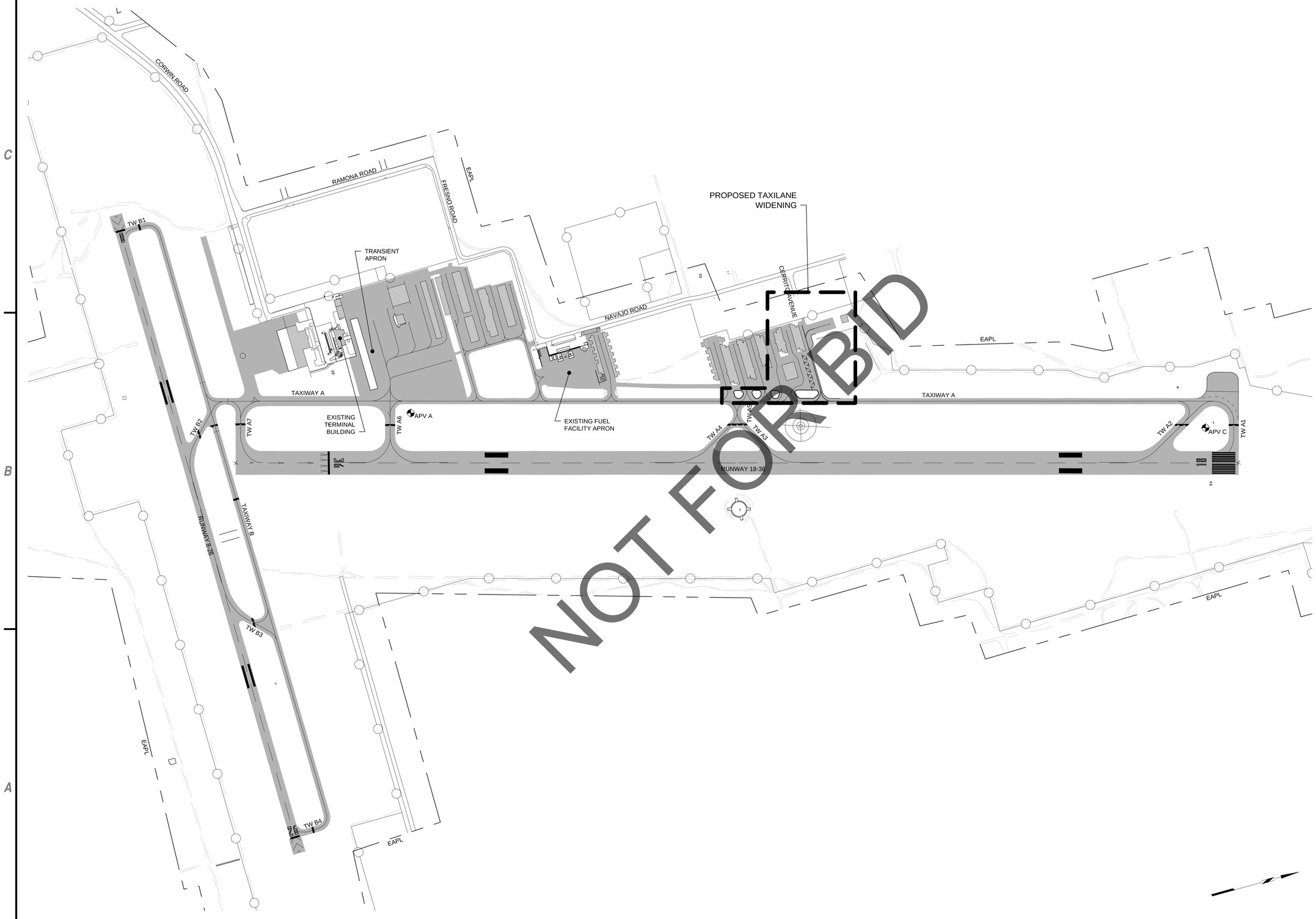
LOCATION MAP

C&S PROJECT: K15.001.006

AUGUST 2024

FINAL

G-001



A1 **GENERAL PLAN**
SCALE: 1" = 300'

300 0 300 600FT.
300'

C&S COMPANIES
C&S Engineers, Inc.
2355 Northside Dr Suite 350
San Diego, California 92108
Phone: 619-296-9373
Fax: 619-296-5683
www.cscos.com

FINAL

SAN BERNARDINO COUNTY

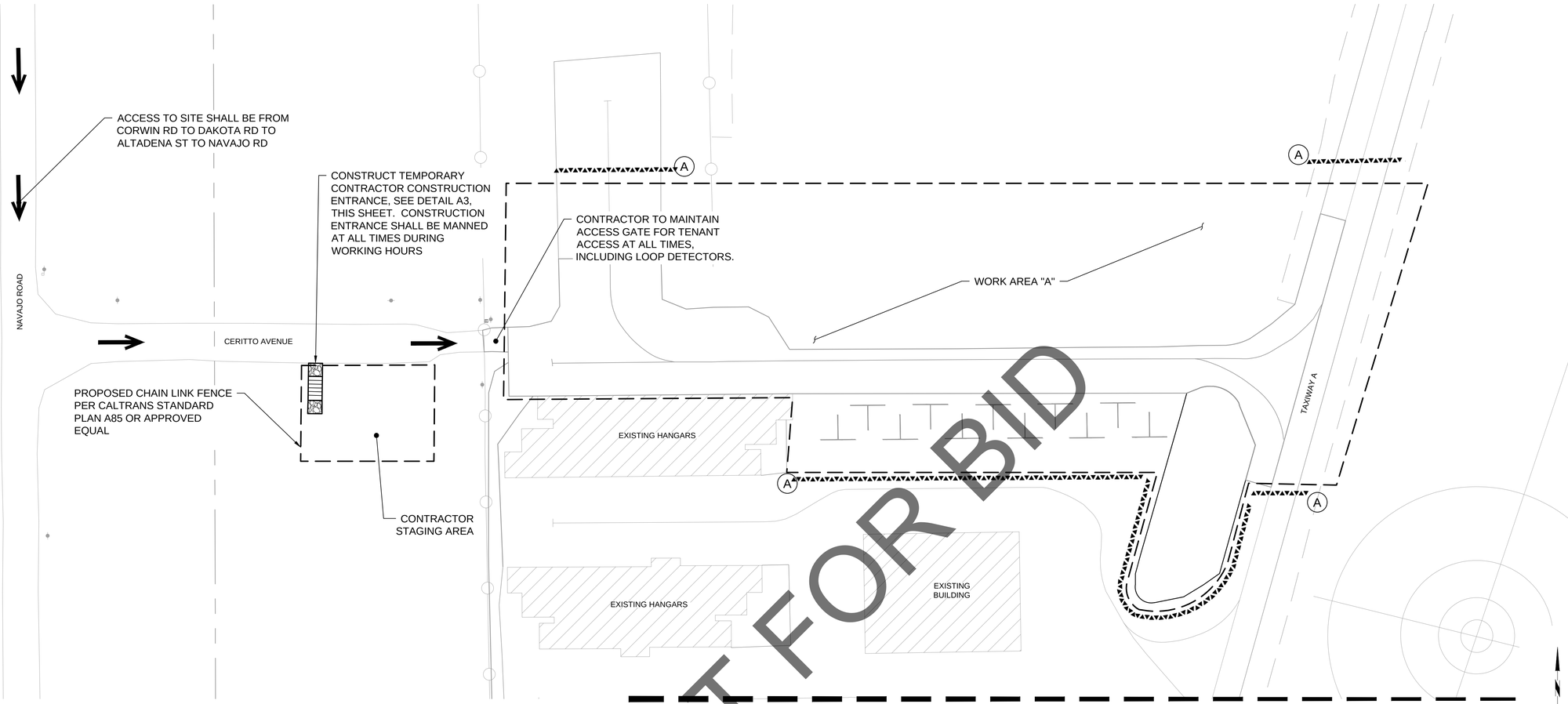
APPLE VALLEY AIRPORT
TAXIWAY REHAB PROJECT
21600 CORWIN ROAD, APPLE VALLEY
SAN BERNARDINO COUNTY, CA, 92307

MARK	DATE	DESCRIPTION
REVISIONS		

PROJECT NO:	K15.001.006
DATE:	AUGUST 2024
DRAWN BY:	JC
DESIGNED BY:	KG
CHECKED BY:	CH

GENERAL PLAN

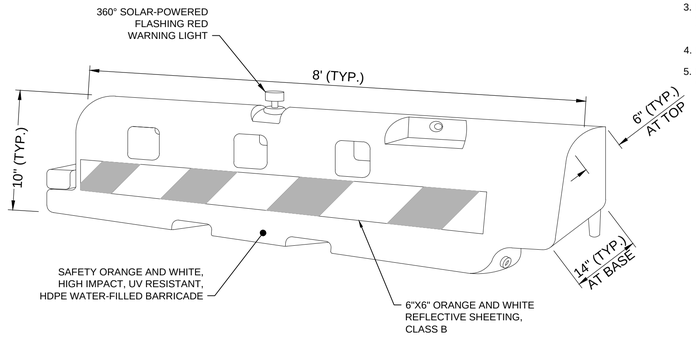
G-101



B1 TAXILANE WIDENING AREA SAFETY PHASING PLAN - WORK AREA A

SCALE: 1" = 40'

40' 0 40 80FT.

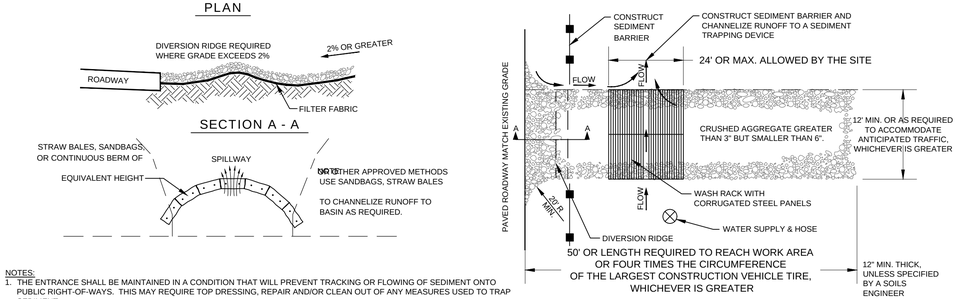


A1 HDPE LOW-PROFILE BARRICADE DETAIL

SCALE: NOT TO SCALE

BARRICADE NOTES:

1. BARRICADES SHALL BE MANUFACTURED BY MULTI-BARRIER, MODEL AR 10 X 96, SHERWIN INDUSTRIES, INC., 2129 WEST MORGAN AVE., MILWAUKEE, WISCONSIN 53221, PHONE: 1-800-525-8876, OR APPROVED EQUAL.
2. FLAT, BIDIRECTIONAL WARNING LIGHTS WILL NOT BE ACCEPTABLE.
3. EXACT LOCATIONS SHALL BE DETERMINED DURING CONSTRUCTION. ALL BARRICADES SHALL BE PLACED AT WORK AREA LIMITS, OR AS OTHERWISE SHOWN ON PLANS.
4. BARRICADES MAY BE SPACED AT A MAXIMUM OF 6' APART.
5. ENSURE BARRICADES ARE SECURE AT ALL TIMES WHILE OPERATIONAL WITHIN AIRFIELD OPERATION AREA.



NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR BASIN.

A3 TEMPORARY CONSTRUCTION ENTRANCE DETAIL (ITEM P-156)

SCALE: NOT TO SCALE

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SAN BERNARDINO COUNTY

APPLE VALLEY AIRPORT TAXIWAY REHAB PROJECT 21600 CORWIN ROAD, APPLE VALLEY SAN BERNARDINO COUNTY, CA, 92307

MARK	DATE	DESCRIPTION

REVISIONS

PROJECT NO:	K15.001.006
DATE:	AUGUST 2024
DRAWN BY:	STB
DESIGNED BY:	KG
CHECKED BY:	CH

CONSTRUCTION SAFETY PHASING PLAN AND DETAILS

G-102

Oct 09, 2023 – 12:21pm
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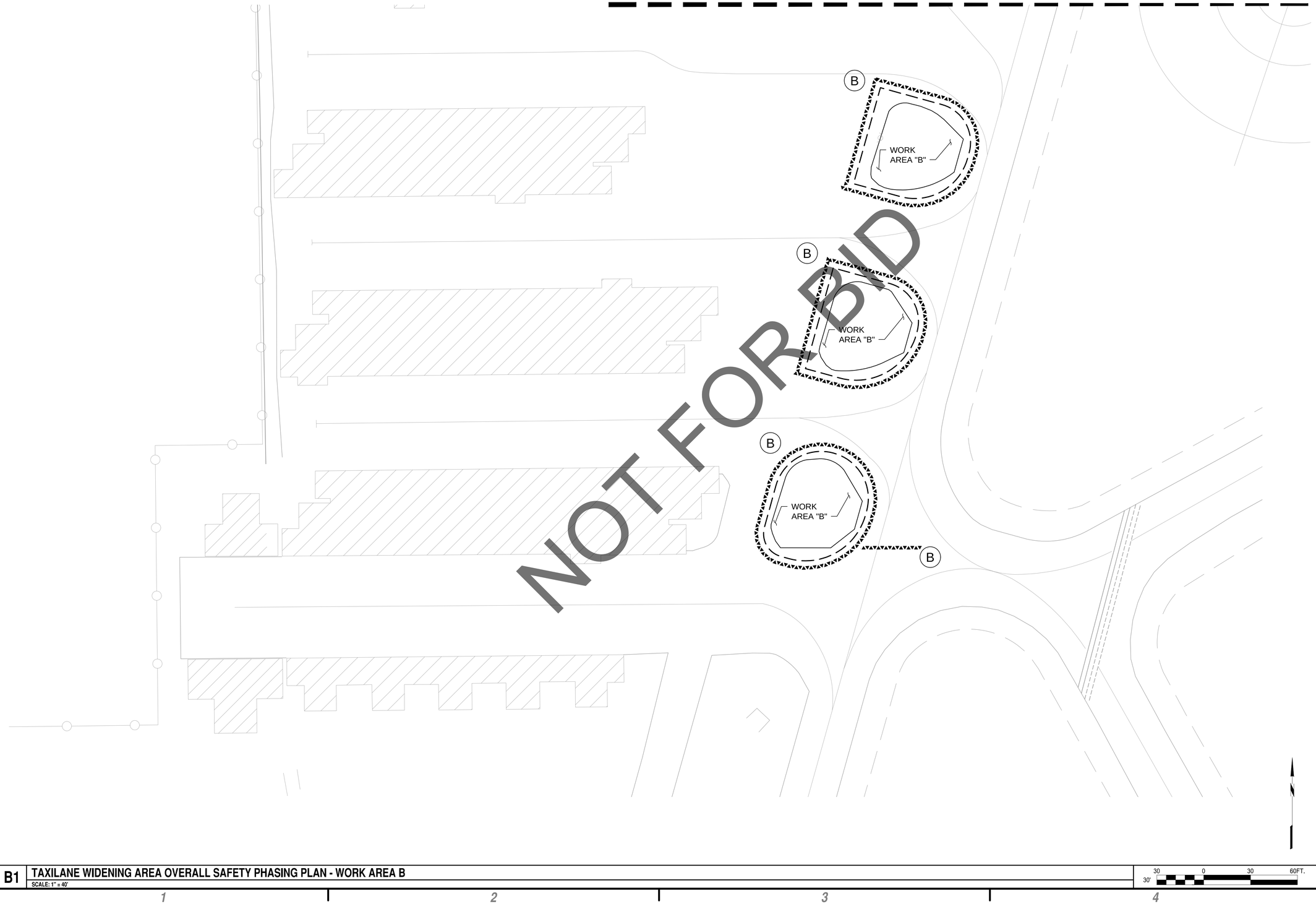
MATCHLINE, SEE SHEET GC102



B1 TAXILANE WIDENING AREA OVERALL SAFETY PHASING PLAN - WORK AREA B

SCALE: 1" = 40'

30' 30 0 30 60FT.

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SAN BERNARDINO COUNTY

APPLE VALLEY AIRPORT
TAXIWAY REHAB PROJECT
21600 CORWIN ROAD, APPLE VALLEY
SAN BERNARDINO COUNTY, CA, 92307

MARK	DATE	DESCRIPTION

REVISIONS

PROJECT NO:	K15.001.006
DATE:	AUGUST 2024
DRAWN BY:	STB
DESIGNED BY:	KG
CHECKED BY:	CH

CONSTRUCTION SAFETY PHASING OVERALL PLAN

G-103

Oct 09, 2023 - 12:20pm
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APPENDIX 2

CONSTRUCTION PROJECT DAILY SAFETY INSPECTION CHECKLIST

Construction Project Daily Safety Inspection Checklist

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety Area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovers holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the contractor may use to aid in identifying and correcting potentially hazardous conditions.

Potentially Hazardous Conditions

Item	Action Required	or	None
Excavation adjacent to runways, taxiways, and aprons improperly backfilled.			☐
Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking.			☐
Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends.			☐
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.			☐
Equipment or material near NAVAIDs that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.			☐
Tall and especially relatively low visibility units (that is, equipment with slim profiles) –cranes, drills, and similar objects—located in critical areas, such as OFZ and approach zones.			☐
Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on an apron, open taxiway, or open taxi lane or in related safety, approach, or departure area.			☐
Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.			☐

Item	Action Required	or	None
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.			☐
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.			☐
Wildlife attractants — such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water — on or near airports.			
Obliterated or faded temporary markings on active operational areas.			☐
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.			☐
Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.			☐
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway / taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services; and/or loss of communications.			☐
Restrictions on first response emergency access from fire stations to the runway / taxiway system or airport buildings.			
Lack of radio communications with construction vehicles in airport movement areas.			☐
Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircraft operations.			☐

Item	Action Required	or	None
Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.			☐
Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.			☐
Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).			
Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits.			☐
Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.			☐
Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.			☐
Site burning, which can cause possible obscuration.			☐
Construction work taking place outside of designated work areas and out of phase.			☐

APPENDIX 3

CONTRACTORS SAFETY PLAN COMPLIANCE DOCUMENT (SPCD)

(The SPCD Certification is located in the Proposal Section)

SAFETY PLAN COMPLIANCE DOCUMENT (SPCD)

Project Location: _____

Project Name: _____

General Statement:

The Construction Safety and Phasing Plan (CSPP), identified as Attachment "A" to Section 80, has been prepared in accordance with FAA Advisory Circular 150/5370-2F, *Operational Safety on Airports During Construction and the requirements of the Airport Owner*. The CSPP has been submitted to the FAA for review and comment. Any comments from the FAA which were received prior to bid opening have been incorporated into the CSPP.

In the event that the FAA transmits comments which require that the CSPP be revised after bid opening, I understand that I am obligated to abide by the conditions and statements contained in the revised CSPP. I further understand that I will be given the opportunity to evaluate the revised CSPP as it relates to my contract and request appropriate compensation in accordance with the provisions of the contract.

Supplemental Information:

Where the CSPP covers a subject and no additional information is needed, the statement below reads, "No supplemental information required". Where additional information is required by the Contractor, the information shall be provided in the spaces below.

The section numbers below correspond with the section numbers in the CSPP.

3.1 Coordination

Statement: [Explain how you will distribute information and details of meetings to employees and subcontractors.]

_____
_____
_____
_____

3.2 Phasing

Statement: [List the number of days each Work Area will take. State the time day work will start and finish for each work area.]

_____
_____
_____
_____

3.3 Areas and operations affected by the construction activity

Statement: Information is provided in the CSPP. No supplemental information is required.

3.4 Protection of NAVAIDs

Statement: Information is provided in the CSPP. No supplemental information is required.

3.5 Contractor Access

Security Statement: [Explain how you will maintain integrity of the airport security fence at the access gate, e.g.: Gate guards, closed and locked gates, temporary fencing, etc.]

Training Statement: [List individuals who will receive driver training (for certificated airports and as requested.]

Communication Statement: [Identify types of radios, if any, you will use to communicate with drivers and personnel. Identify who will be monitoring radios. Identify a contact person and phone number if ATCT cannot reach the contractor's designated person by radio.]

Escort Statement: [Identify who will escort material delivery vehicles.]

3.6 Wildlife Management

Statement: [Identify who will be monitoring wildlife in the construction area. Identify who will be monitoring wildlife at the construction gate.]

3.7 Foreign Object Debris (FOD) Management

Statement: [Identify who will be preparing a FOD Management Plan. (Plan must be approved prior to the start of construction activities.)]

3.8 Hazardous material (HAZMAT) management

Statement: [Identify who will be preparing a Spill Prevention Plan. (Plan must be approved prior to the start of construction activities.)]

3.9 Notification of construction activities. Provide the following:

Key Personnel Statement: [Identify your key personnel points of contact with phone numbers.]

Emergency Contacts Statement: [Identify your emergency contacts with 24 hour phone numbers.]

Equipment Statement: [Part 77: Identify equipment you will be using that is taller than feet, including on-site batch plants. Identify the maximum height it will be extended to during construction for each Work Area and the expected duration. Identify when during the day it will be used.]

3.10 Inspection requirements.

Statement: [Identify the person who will be responsible for daily inspections to ensure conformance with the CSPP. Describe additional inspections you will employ, if any, to ensure conformance.]

3.11 Underground utilities.

Statement: [Discuss proposed methods of identifying and protecting underground utilities.]

3.12 Penalties

Statement: Information is provided in the CSPP. No supplemental information is required.

3.13 Special conditions.

Statement: [Identify who will be responsible for moving equipment and personnel from the work area and vacating the area in the event of a special condition listed in the CSPP.]

3.14 Runway and taxiway visual aids. Including marking, lighting, signs, and visual NAVAIDs.

Statement: Information is provided in the CSPP. No supplemental information is required.

3.15 Marking and signs for access routes. Discuss proposed methods of demarcating access routes for vehicle drivers.

Statement: Information is provided in the CSPP. No supplemental information is required.

3.16 Hazard marking and lighting.

Statement: [Identify who will be responsible for maintaining hazard marking and lighting. Include a 24 hour phone number.]

3.17 Protection of taxiway and runway safety areas. Include object free areas, obstacle free zones, approach/departure surfaces and safety areas as required. Discuss proposed methods of identifying, demarcating, and protecting airport surfaces including:

Equipment and methods for maintaining Taxiway/Taxilane Safety Area standards.

Statement: Information is provided in the CSPP. No supplemental information is required.

Equipment and methods for separation of construction operations from aircraft operations, including details of barricades.

Statement: Information is provided in the CSPP. No supplemental information is required.

3.18 Other limitations on construction.

Other limitations are identified in the CSPP and do not require an entry in this document.

APPENDIX 4

SPOIL DEPOSITION RELEASE FORM

SPOILS DEPOSITION RELEASE FORM

To:_____ (OWNER), and

_____ (ENGINEER).

Project: _____

This SPOILS DEPOSITION RELEASE FORM is being forwarded to the above referenced OWNER and ENGINEER to satisfy the Contract Documents governing the above referenced project. Pursuant to the Contract Documents, LANDOWNER has granted permission to CONTRACTOR to deposit spoils at LANDOWNER'S property located at _____ (give specific location). Further, CONTRACTOR hereby agrees to the greatest extent of the law, to release, indemnify, hold harmless, and defend the OWNER and ENGINEER from any and all damage, liability, or cost (including reasonable attorney's fees and cost of defense) to the extent caused by or arising out of the deposition of the spoils on LANDOWNER'S property.

CONTRACTOR:	**LANDOWNER:**
_____	_____
Signature	Signature
_____	_____
Written Name & Title	Written Name & Title
_____	_____
Company Name	Company Name
_____	_____
Mailing Address (Street Name and Number)	Mailing Address (Street Name and Number)
_____	_____
City, State, Zip Code	City, State, Zip Code
_____	_____
Daytime Phone Number (Include Area Code)	Daytime Phone Number (Include Area Code)
_____	_____
Date	Date

Item C-100 Contractor Quality Control Program (CQCP)

100-1 General. Quality is more than test results. Quality is the combination of proper materials, testing, workmanship, equipment, inspection, and documentation of the project. Establishing and maintaining a culture of quality is key to achieving a quality project. The Contractor shall establish, provide, and maintain an effective Contractor Quality Control Program (CQCP) 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 Contractor shall establish a CQCP that will:

a. Provide qualified personnel to develop and implement the CQCP.

b. Provide for the production of acceptable quality materials.

c. Provide sufficient information to assure that the specification requirements can be met.

d. Document the CQCP process.

The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the CQCP has been reviewed and approved by the Resident Project Representative (RPR). No partial payment will be made for materials subject to specific quality control (QC) requirements until the CQCP has been reviewed and approved.

The QC requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the quality assurance (QA) testing requirements. QA testing requirements are the responsibility of the RPR or Contractor as specified in the specifications.

A Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Resident Project Representative (RPR), Contractor, subcontractors, testing laboratories, and Owner's representative must be held prior to start of construction. The QC/QA workshop will be facilitated by the Contractor. The Contractor shall coordinate with the Airport and the RPR on time and location of the QC/QA workshop. Items to be addressed, at a minimum, will include:

a. Review of the CQCP including submittals, QC Testing, Action & Suspension Limits for Production, Corrective Action Plans, Distribution of QC reports, and Control Charts.

b. Discussion of the QA program.

c. Discussion of the QC and QA Organization and authority including coordination and information exchange between QC and QA.

d. Establish regular meetings to discuss control of materials, methods and testing.

e. Establishment of the overall QC culture.

100-2 Description of program.

a. General description. The Contractor shall establish a CQCP to perform QC inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. The CQCP shall ensure conformance to applicable specifications and plans with respect to materials, off-

site fabrication, workmanship, construction, finish, and functional performance. The CQCP 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 QC.

b. Contractor Quality Control Program (CQCP). The Contractor shall describe the CQCP in a written document that shall be reviewed and approved by the RPR prior to the start of any production, construction, or off-site fabrication. The written CQCP shall be submitted to the RPR for review and approval at least 10 calendar days before the CQCP Workshop. The Contractor's CQCP and QC testing laboratory must be approved in writing by the RPR prior to the Notice to Proceed (NTP).

The CQCP shall be organized to address, as a minimum, the following:

1. QC organization and resumes of key staff
2. Project progress schedule
3. Submittals schedule
4. Inspection requirements
5. QC testing plan
6. Documentation of QC activities and distribution of QC reports
7. Requirements for corrective action when QC and/or QA acceptance criteria are not met
8. Material quality and construction means and methods. Address all elements applicable to the project that affect the quality of the pavement structure including subgrade, subbase, base, and surface course. Some elements that must be addressed include, but is not limited to mix design, aggregate grading, stockpile management, mixing and transporting, placing and finishing, quality control testing and inspection, smoothness, laydown plan, equipment, and temperature management plan.

The Contractor must add any additional elements to the CQCP that is necessary to adequately control all production and/or construction processes required by this contract.

100-3 CQCP organization. The CQCP shall be implemented by the establishment of a QC organization. An organizational chart shall be developed to show all QC personnel, their authority, and how these personnel integrate with other management/production and construction functions and personnel.

The organizational chart shall identify all QC staff by name and function, and shall indicate the total staff required to implement all elements of the CQCP, 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 CQCP, the personnel assigned shall be subject to the qualification requirements of paragraphs 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The QC organization shall, as a minimum, consist of the following personnel:

a. Program Administrator. The Contractor Quality Control Program Administrator (CQCPA) must be a full-time on-site employee of the Contractor, or a consultant engaged by the Contractor. The CQCPA must have a minimum of five (5) years of experience in QC pavement construction with prior QC experience on a project of comparable size and scope as the contract.

Included in the five (5) years of paving/QC experience, the CQCPA must meet at least one of the following requirements:

(1) Professional Engineer with one (1) year of airport paving experience.

(2) Engineer-in-training with two (2) years of airport paving experience.

(3) National Institute for Certification in Engineering Technologies (NICET) Civil Engineering Technology Level IV with three (3) years of airport paving experience.

(4) An individual with four (4) years of airport paving experience, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.

The CQCPA must have full authority to institute any and all actions necessary for the successful implementation of the CQCP to ensure compliance with the contract plans and technical specifications. The CQCPA authority must include the ability to immediately stop production until materials and/or processes are in compliance with contract specifications. The CQCPA must report directly to a principal officer of the construction firm. The CQCPA may supervise the Quality Control Program on more than one project provided that person can be at the job site within two (2) hours after being notified of a problem.

b. QC technicians. A sufficient number of QC technicians necessary to adequately implement the CQCP must be provided. These personnel must be either Engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II in Civil Engineering Technology or higher, and shall have a minimum of two (2) years of experience in their area of expertise.

The QC technicians must report directly to the CQCPA 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 paragraph 100-6.

(2) Performance of all QC tests as required by the technical specifications and paragraph100-8.

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

Certification at an equivalent level of qualification and experience by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

c. Staffing levels. The Contractor shall provide sufficient qualified QC 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 CQCP shall state where different technicians will be required for different work elements.

100-4 Project progress schedule. Critical QC activities must be shown on the project schedule as required by Section 80, paragraph 80-03, *Execution and Progress*.

100-5 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 can be developed in a spreadsheet format and shall include as a minimum:

a. Specification item number

b. Item description

c. Description of submittal

d. Specification paragraph requiring submittal

e. Scheduled date of submittal

100-6 Inspection requirements. QC 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 paragraph 100-9.

Inspections shall be performed as needed to ensure continuing compliance with contract requirements until completion of the particular feature of work. Inspections shall include the following minimum requirements:

a. During plant operation for material production, QC 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 CQCP shall detail how these and other QC functions will be accomplished and used.

b. During field operations, QC 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 CQCP shall document how these and other QC functions will be accomplished and used.

100-7 Contractor QC testing facility.

a. For projects that include Item P-401, Item P-403, and Item P-404, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM D3666, *Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*:

- 8.1.3 Equipment Calibration and Checks;
- 8.1.9 Equipment Calibration, Standardization, and Check Records;
- 8.1.12 Test Methods and Procedures

b. For projects that include P-501, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation:

- 7 Test Methods and Procedures
- 8 Facilities, Equipment, and Supplemental Procedures

100-8 QC testing plan. As a part of the overall CQCP, the Contractor shall implement a QC 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 QC tests that the Contractor deems necessary to adequately control production and/or construction processes.

The QC testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

a. Specification item number (e.g., P-401)

b. Item description (e.g., Hot Mix Asphalt Pavements)

c. Test type (e.g., gradation, grade, asphalt content)

d. Test standard (e.g., ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)

e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated)

f. Responsibility (e.g., plant technician)

g. Control requirements (e.g., target, permissible deviations)

The QC testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The RPR shall be provided the opportunity to witness QC sampling and testing.

All QC test results shall be documented by the Contractor as required by paragraph 100-9.

100-9 Documentation. The Contractor shall maintain current QC records of all inspections and tests performed. These records shall include factual evidence that the required QC 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 RPR daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the CQCPA.

Contractor QC records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily inspection reports. Each Contractor QC technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician's daily reports shall provide factual evidence that continuous QC 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) Summary of any necessary corrective actions
(7) Safety inspection.
(8) Photographs and/or video

The daily inspection reports shall identify all QC inspections and QC tests conducted, 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 QC technician and the CQCPA. The RPR shall be provided at least one copy of each daily inspection report on the work day following the day of record. When QC inspection and test results are recorded and transmitted electronically, the results must be archived.

b. Daily test reports. The Contractor shall be responsible for establishing a system that will record all QC test results. Daily test reports shall document the following information:

(1) Technical specification item number and description
(2) Test designation
(3) Location
(4) Date of test
(5) Control requirements

(6) Test results
(7) Causes for rejection
(8) Recommended remedial actions
(9) Retests

Test results from each day's work period shall be submitted to the RPR prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical QC charts. When QC daily test results are recorded and transmitted electronically, the results must be archived.

100-10 Corrective action requirements. The CQCP 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 CQCP as a whole, and for individual items of work contained in the technical specifications.

The CQCP shall detail how the results of QC inspections and tests will be used for determining the need for corrective action and shall contain clear 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 QC charts for individual QC tests. The requirements for corrective action shall be linked to the control charts.

100-11 Inspection and/or observations by the RPR. All items of material and equipment are subject to inspection and/or observation by the RPR at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate QC 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 inspection and/or observation by the RPR at the site for the same purpose.

Inspection and/or observations by the RPR does not relieve the Contractor of performing QC inspections of either on-site or off-site Contractor's or subcontractor's work.

100-12 Noncompliance.

a. The Resident Project Representative (RPR) will provide written notice to the Contractor of any noncompliance with their CQCP. After receipt of such notice, the Contractor must take corrective action.

b. When QC activities do not comply with either the CQCP or the contract provisions or when the Contractor fails to properly operate and maintain an effective CQCP, and no effective corrective actions have been taken after notification of non-compliance, the RPR will recommend the Owner take the following actions:

(1) Order the Contractor to replace ineffective or unqualified QC personnel or subcontractors and/or

(2) Order the Contractor to stop operations until appropriate corrective actions are taken.

METHOD OF MEASUREMENT

100-13 Basis of measurement and payment. Contractor Quality Control Program (CQCP) is for the personnel, tests, facilities and documentation required to implement the CQCP. The CQCP will be paid as a lump sum with the following schedule of partial payments:

a. With first pay request, 25% with approval of CQCP and completion of the Quality Control (QC)/Quality Assurance (QA) workshop.

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 20%.

d. When 75% or more of the original contract is earned, an additional 20%

e. After final inspection and acceptance of project, the final 10%.

BASIS OF PAYMENT

100-14 Payment will be made under:

Item C-100 Contractor Quality Control Program (CQCP) – per Lump Sum

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
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

END OF ITEM C-100

Item C-102 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

102-1. This item shall consist of temporary control measures as shown on the plans or as ordered by the Resident Project Representative (RPR) during the life of a contract to control pollution of air and water, 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. Control measures shall also be in accordance with the Storm Water Pollution Prevention Plan (SWPPP) included hereafter as Attachment "A".

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2, *Operational Safety on Airports During Construction*. 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 designed, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

102-2.1 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

102-2.2 Silt fence. 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.

Fabric shall be recommended by the manufacturer for use as a silt fence and shall have the following properties:

Physical Properties	Requirements	Test Method
Grab Strength for Supported Fence		
Machine Direction	90 lbs. (MARV) for supported fence	ASTM D 4632
X-Machine Direction	90 lbs. (MARV)) for supported fence	ASTM D 4632
Grab Strength for Unsupported Fence		
Machine Direction	125 lbs. (MARV)) for unsupported fence	ASTM D 4632
X-Machine Direction	100 lbs. (MARV)) for unsupported fence	ASTM D 4632
Permittivity 0.05 sec^{-1} (min.)	ASTM D 4491	
Apparent Opening Size	#30 U.S. Std. Sieve (max.)	ASTM D 4751
Apparent Opening Size	#50 U.S. Std. Sieve (max.)	ASTM D 4751
Ultraviolet 70 % (min.) retained strength after 500h		ASTM D 4355

Wood posts shall be of sound quality hardwood with minimum dimensions of 1.2 inches by 1.2 inches by 36 inches long. Supported silt fence shall have a maximum post spacing of 4 feet. Unsupported silt fence with elongation $\geq$ 50% shall have a maximum post spacing of 4 feet. Unsupported silt fence with elongation < 50% shall have a maximum post spacing of 2 feet.

Wire fence shall be 14 gauge minimum with maximum 6 inch mesh opening.

102-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the RPR before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

102-3.1 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 RPR shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

102-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans 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 RPR.

102-3.3 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 plans and approved CSPP. 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, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The RPR 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 measures 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 RPR.

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 RPR. 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 RPR, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The RPR 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 maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. 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.

102-3.4 Installation, maintenance and removal of silt fence. 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 RPR.

METHOD OF MEASUREMENT

102-4.1 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.

BASIS OF PAYMENT

102-5.1 Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the RPR and measured as provided in paragraph 102-4.1 will be paid for under:

Item C-102-5.1 Compliance W/Pollution, Erosion & Siltation Control lump sum

Where other directed work falls within the specifications for a work item that has a contract price, the units of work shall be measured and paid for at the contract unit price bid for the various items.

Temporary control features not covered by contract items that are ordered by the RPR will be paid for in accordance with Section 90, paragraph 90-05 *Payment for Extra Work*.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5200-33 *Hazardous Wildlife Attractants on or Near Airports*

AC 150/5370-2 *Operational Safety on Airports During Construction*

ASTM International (ASTM)

ASTM D6461 *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM C-102

Item C-105 Mobilization

105-1 Description. This item of work shall consist of, 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.

105-2 Mobilization limit. Mobilization shall be limited to 10 percent of the total project cost.

105-3 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.

105-4 Engineer/RPR field office and equipment. An Engineer/RPR field office is not required.

METHOD OF MEASUREMENT

105-5 .1 Measurement for payment of mobilization will be made on a lump sum basis. Measurement for partial payment of mobilization will be made based percentage of work completed in accordance with the schedule shown in Section 6.1.

BASIS OF PAYMENT

105-6.1 Payment for mobilization will be made on a lump sum basis. Based upon the contract lump sum price for "Mobilization" partial payments will be allowed as follows:

a. With first pay request, 25%.

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 Section 90, paragraph 90-11, *Contractor Final Project Documentation,* the final 10%.

Payment will be made under:

Item C-105-6.1 Mobilization – per lump sum

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246, as amended

EEOC-P/E-1 – Equal Employment Opportunity is the Law Poster

United States Department of Labor, Wage and Hour Division (WHD)

WH 1321 – Employee Rights under the Davis-Bacon Act Poster

END OF ITEM C-105

Item P-120 Cold Milling Existing Pavements

DESCRIPTION

120-1.1 This item shall consist of the removal of existing bituminous and concrete pavement by cold milling, and the disposal of milled pavement as shown on the Contract Drawings or as directed by the Engineer.

Prior to disturbing original grade, Contractor shall verify the accuracy of existing elevations by verifying spot elevations at the same locations where original field survey data was obtained in accordance with Item M-150, SURVEY & STAKEOUT.

CONSTRUCTION METHODS

120-2.1 Cold milling. Cold milling operations shall not proceed until the manufacturer´s instructions for the herbicide applied in accordance with Item P-101 Surface Preparation indicates that vegetation may be removed.

Cold milling of existing pavement shall be accomplished by the use of milling machines to the limits and depths shown on the Contract Drawings.

The limits of the excavations shall be saw cut to the depths required prior to milling. The machine shall have a minimum width of 10 feet, unless otherwise approved. Methods and equipment shall be such that the existing bituminous or concrete pavement which is to remain is not disturbed. The machine shall be capable of discharging the millings in a truck or leaving them in a defined windrow. A positive method of dust control shall be provided. All material shall be immediately removed from the milled surfaces and adjacent surfaces. Surfaces shall be cleaned of all fines and dust prior to opening to traffic. The Contractor shall conduct operations in such a manner that dust is controlled and is not objectionable. Milled and adjacent surfaces shall be re-cleaned, when directed by the Engineer, prior to the placement of tack coats, or pavement courses if traffic has been allowed on the milled surface and/or if more than 48 hours have elapsed since the initial cleaning. Milled longitudinal or transverse vertical faces exceeding 1-1/2 inches in height that would be exposed to traffic shall be sloped or tapered by constructing temporary asphalt ramps, unless otherwise approved by the Engineer. The maximum grade for temporary ramps shall not exceed 5 percent. The temporary ramp shall be removed prior to placement of tack coat or pavement courses. No payment will be made for placement or removal of temporary ramps.

Any area that is milled outside the proposed limits because the Contractor doesn't have the appropriate machine, or areas that are damaged because of his negligence, shall not be included in the measurement for payment. In addition, the Contractor shall repair the areas at their own expense.

120-2.2 Spoil. All spoil material as a result of cold milling shall become the property of the Owner, and shall be stockpiled at the location shown on the Contract Drawings.

No direct payment will be made for spoiling operations. The cost of spoiling material on site, or of hauling spoil material off-site, shall be considered incidental to this Contract and the costs shall be included in the various pay items involved.

METHOD OF MEASUREMENT

120-3.1 Measurement for cold milling existing pavement shall be the number of square yards of existing pavement milled in accordance with this specification, completed and accepted by the Engineer.

BASIS OF PAYMENT

120-4.1 Payment will be made at the contract unit price per square yard for cold milling existing pavement. This price shall be full compensation for furnishing all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Item P-120-4.1 - Cold Milling Existing Pavement - per square yard

END OF ITEM P-120

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 and grubbing shall consist of clearing the surface of the ground of the designated areas of all 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, including wetland boundaries and wetland buffers, and trees to be removed shall be staked on the ground by a licensed land surveyor hired by the Contractor. Each stake shall be located at an interval that allows for visual inspection from one stake to the next without the use of any special equipment. A survey map shall be provided by the Contractor's Surveyor showing the metes and bounds between all boundary stakes for the area to be cleared and grubbed. Points on the map shall be referenced to the project horizontal control. The survey map of the actual field points set shall be approved by the Engineer prior to the Contractor commencing work on this item. Contractor's Surveyor shall also provide a point data file in ASCII format, and a digital file of the map in DXF compatible format on a CD-ROM or disk with loading and unloading instructions.

Should a Global Positional System (GPS) survey device be used to establish the field points as identified on the contract plans, a field record, i.e. a GPS occupied site detail printout, of each field point set shall be provided.

In the event the Contractor discovers any apparent error or discrepancy in the field layout of the points in comparison with the contract mapping or Contractor's understanding of the intent of the project, he shall immediately call upon the Engineer for his/her interpretation and decision, and such decision shall be final.

Identification of Airport property lines for the purpose of identifying work limits shall be the responsibility of the Contractor. Where trees are to be removed off airport property, the Contractor shall provide a schedule indicating removal dates so the work can be coordinated with the property owner. The clearing and grubbing shall be done at a satisfactory distance in advance of the grading operations.

151-2.2 Wetland Clearing. Not Used

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. 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 Tree removal on airport property. All trees designated to be removed shall be field flagged or painted by the Contractor and field verified and approved by the Engineer prior to the Contractor commencing with any work of this item.

All stumps shall be removed or reduced to chips by the use of an approved chipping machine or stump grinder. Stump grinding shall be at a minimum depth of one foot below existing grade. Chips shall be one-half inch maximum thickness. Chips resulting there from shall be disposed of in a satisfactory manner by the Contractor as specified herein.

When no other soil disturbance will occur as a result of this project, the ground shall be leveled in accordance with the requirements specified below.

151-2.5 Tree removal on private property. Not Used

151-2.6 Disposal. All land cleared material shall be disposed of immediately after wetland clearing, clearing and grubbing, and tree removal operations. No blasting or burning of land cleared materials shall be permitted. 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 materials be left in windrows or piles adjacent to or within the airport limits. No separate payment will be made for disposal. Contractor shall consider the costs of disposal in the various pay items involved. The Contractor shall dispose of all land cleared materials as follows:

A. Excavated stumps and all remaining materials resulting from land clearing operations shall be disposed of off-site at an area designated by the Contractor.

Disposal shall not be made in a swamp or wetlands and shall be in accordance with all Federal, State and Local regulations. The Contractor shall submit the "Spoils Deposition Release Form" for any spoils which are transported from the project site.

151-2.7 Leveling of ground surface. All areas that have been cleared and grubbed and which are outside of proposed grading limits shall be graded adequately to accommodate Sponsor owned mowing equipment. Areas of abrupt transition in grade which would not allow the passage of mowing equipment will not be allowed. Rocks and boulders which protrude above the ground surface by more than 2 inches shall be buried on site or excavated and removed from the site. All rocks or boulders that are essentially flush with the surrounding ground surface and will allow the safe passage of mowing equipment may remain.

151-2.8 Restoration. After clearing and grubbing operations are completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site.

All areas disturbed by the Contractor's operation shall be restored to its original condition at no cost to the Owner. Restoration of surfaces shall be performed in accordance with the details shown on the plans.

Where clearing and grubbing operations are performed outside of the general grading limits, or in areas that would not otherwise be disturbed, the Contractor shall restore all disturbed areas in accordance with the topsoil, seeding and mulching specifications of this Contract. Restoration of these areas shall be considered necessary and incidental to the work of this item and the costs shall be included in the associated pay items of work involved.

Where clearing and grubbing operations are performed within the general grading limits, restoration of the area will not be necessary as payment for establishment of turf or pavement will be included in the various pay items of work involved.

The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

151-2.9 Restoration on private property. After clearing and grubbing operations are completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site.

All surfaces, including lawns, landscaped areas, sidewalks, curbs, driveways and pavements damaged by the Contractor's operations shall be restored to their original condition. The Contractor shall restore all disturbed areas to a condition equal to or better than the surrounding area.

Restoration of turf areas on private property is intended to establish a lawn which is level and evenly graded with no sharp breaks in grade, and that is able to be maintained by the property owner with their mowing equipment. All stump holes ruts and depressions shall be backfilled with topsoil compacted to the satisfaction of the Engineer.

The Contractor shall clean the area of all litter and debris resulting from the tree removal operation.

No separate measurement for payment shall be made for restoration on private property. Restoration shall be considered necessary and incidental to the work of this item and the costs shall be included in the various pay items involved.

METHOD OF MEASUREMENT

151-3.1 No measurement will be made for direct payment of wetland clearing, clearing and grubbing, and tree removal, as the cost of performing this work shall be considered as a subsidiary obligation in the completion of work.

SUBMITTALS AND CERTIFICATIONS

151-5.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Survey map of the areas to be cleared and grubbed
- A point data file in ASCII format and a digital file in DXF compatible format.

END OF ITEM P-151

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. Excavation and compaction shall be in accordance with Caltrans Section 19, unless otherwise described herein.

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, which is not otherwise classified and paid for under one of the following items.

MATERIALS

152-2.1 Unsuitable excavation. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material, suitable for topsoil may be used for embankment construction outside of runway and taxiway safety areas, and outside of other paved areas when approved by the Engineer.

152-2.2 Suitable material. A material whose composition is satisfactory for use in embankment construction is designated as a suitable material. The moisture content has no bearing upon such designation, however, the moisture content of a material may be such that its use will require extensive manipulation. It is the Contractor's responsibility to determine the economics of using, or disposing and replacing, such materials. Materials which are defined to be suitable by this specification but determined by the Contractor to be un-economical for use shall be disposed of and replaced with other material at no additional cost to the Owner. In general, any mineral (inorganic) soil, blasted or broken rock and similar materials of natural or manmade origin, including mixtures thereof, are considered as suitable materials. Presence of oversize particles in the otherwise suitable material will not render the material unsuitable. In the event the Contractor determines that removal of the oversize material is uneconomical, he will be allowed to dispose of and replace with suitable material meeting the specification requirements at no additional cost to the Owner.

CONSTRUCTION METHODS

152-3.1 General. Construction methods for excavation shall generally be in accordance with Caltrans Section 19, unless otherwise stated herein.

This project includes the construction of airport pavements. Airport pavements differ significantly from the construction of highway pavements and other traffic pavement applications. In some cases, the aircraft for which the pavement is being built may be lighter than many commonly available pieces of construction and hauling equipment. Construction equipment, methods and means for construction of pavements on this project are the responsibility of the Contractor. However the Contractor should be aware that common methods, means and equipment selections that may be appropriate for other pavements in the same local area as this project may not be appropriate for the construction of pavements under this Contract. The Contractor's special attention is called to the fact that it is his responsibility to select proper equipment, means and methods to meet the requirements of the specifications.

The Contractor's special attention is called to the fact that subgrade soils under pavements are expected to be poorly drained, clayey sand and highly variable and possibly cohesive. The Contractor shall take these factors into consideration when selecting equipment, means and methods of excavation, hauling, placement and compaction for the construction of this project, specifically when considering compaction of subgrade soils and granular courses in the pavement section, as well as hauling equipment that will operate in pavement areas throughout the construction process. The Contractor shall exert proper control over the lift thickness and moisture content during construction. Should the equipment, means and methods adversely affect subgrade soils and/or previously constructed pavement sections, the Contractor shall reconstruct and repair all damaged areas at no additional cost to the Owner and with no adjustment to time for completion of construction. It is the Contractor's responsibility to make field investigations of subgrade soils prior to bidding if, in the opinion of the Contractor, he requires additional information in order to make prebid determinations of the equipment, means and methods to be used during construction.

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.

Method of measurement for excavation, as described later in this specification, relies on the comparison of digital terrain model (DTM) surfaces for computation of neat line design quantities. Prior to disturbing original grade, Contractor shall verify the accuracy of existing elevations by verifying spot elevations at the same locations where original field survey data was obtained in accordance with Item M-150, SURVEY & STAKEOUT.

The quantity of unclassified excavation stated in the bid is based in part on the depths of existing asphalt pavement to be removed in accordance with Item P-120. If the depths shown on the plans differ from those removed, the Engineer will use the actual depths removed to re-calculate the neat line Unclassified Excavation quantity. The average depth of pavement excavation used in the computation of quantities for this project was 3inches.

a. Verification of Existing Grades. This project was developed using a three-dimensional (3D) computer aided drafting and design (CADD) program. The 3D CADD program created digital terrain model (DTM) files of the existing surfaces, finished surfaces and other various surfaces required to complete the design.

Some volumetric quantities were calculated by comparing DTM files of the applicable design surfaces and generating Triangle Volume Reports. Electronic copies of DTM files and a paper copy of the original topographic map will be issued to the successful bidder.

Existing grades on the design cross sections or DTM’s, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM’s. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor

demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within 0.1 foot of the stated elevations for ground surfaces, or within 0.02 foot for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered “no change”. Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's verification identifies discrepancies in the topographic map, Contractor shall notify Engineer in writing at least two weeks before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM’s. Disturbance of existing grade in any area shall constitute acceptance by the Contractor of the accuracy of the original elevations shown on the topographic map for that area.

152-3.2 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, and the Contractor has agreed that the original ground lines shown on the original topographic mapping are accurate. 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. 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 as specified or as shown on the plans.

When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or disposed as directed by the Engineer. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from 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.The work shall be performed in the proper sequence with the other construction. Intercepting ditches shall be constructed prior to starting adjacent excavation operations. Excavated material shall be used to restore the area to original condition, unless otherwise directed by the Engineer. The Contractor shall use pumps and/or otherwise dewater as necessary to maintain the work area. No separate measurement or payment will be made for this work as it is considered necessary and incidental to the work items involved.

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 until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

b. Undercutting. Undercutting shall be performed only when directed by the Engineer as follows:

(1) In Excavated Areas Under Proposed Pavement: Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades under proposed pavement (runways, taxiways, aprons, roads, shoulders), 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 directed by the Engineer. Unsuitable materials shall be disposed of in accordance with the Spoil section of this specification, unless otherwise noted. 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 and compacted to specified densities. Where rock cuts are made, any pockets created in the rock surface shall be shaped to drain freely, or as directed by the Engineer. Undercut areas, wherever

possible, shall be graded to drain to underdrains, or weeps shall be constructed to daylight at locations as directed by the Engineer. No payment will be made for refilling the undercut area as it is considered an incidental and necessary part of the work involved.

(2) In Embankment Areas under Proposed Pavement: Muck, peat, matted roots or other yielding materials unsuitable for embankment foundation, shall be removed to the depths directed by the Engineer. Undercut areas under proposed pavement, wherever possible, shall be graded to drain to underdrains, or weeps shall be constructed to daylight at locations as directed by the Engineer. 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 refilled with suitable material obtained from the grading operations or borrow areas as directed by the Engineer and compacted to specified densities. Where rock cuts are made, any pockets created in the rock surface shall be shaped to drain freely, or as directed by the Engineer. Undercut areas, wherever possible, shall be graded to drain to underdrains, or weeps shall be constructed to daylight at locations as directed by the Engineer. No payment will be made for refilling the undercut area as it is considered an incidental and necessary part of the work involved.

(3) In Excavated Areas within Runway Safety Areas and Areas to be Turfed: Rock, shale, hardpan, loose rock, boulders or other materials unsatisfactory for subgrades beneath topsoil shall be removed to a minimum depth of 12 inches below final grade, or as directed by the Engineer. Muck, peat, matted roots or other yielding materials shall be removed to the depth directed by the Engineer. 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 refilled with suitable material obtained from the grading operations or borrow areas as directed by the Engineer and compacted to specified densities. Where rock cuts are made, any pockets created in the rock surface shall be shaped to drain freely, or as directed by the Engineer. Undercut areas, wherever possible, shall be graded to drain to underdrains, or weeps shall be constructed to daylight at locations as directed by the Engineer. No payment will be made for refilling the undercut area as it is considered an incidental and necessary part of the work involved.

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 removed by the Contractor and disposed of as directed by the Engineer. The overbreak area shall be backfilled and compacted with suitable on-site material. 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 material, or for the filling and compacting required to repair overbreak areas 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 someone other than the Contractor; for example, the utility 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.

Where removal of utilities are shown to be the contractor's responsibility, the work shall be coordinated with the utility owner. Removal and disposal of utilities and related structures shall be considered incidental to the work involved and the cost shall be included in the various pay items involved, unless paid for otherwise.

e. Compaction requirements for excavations. Compaction shall be as noted on the plans.

f. Proof rolling. After compaction is completed, the subgrade area shall be proof rolled with a 20 ton (18.1 metric ton) Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to a minimum 80 psi in the presence of the Engineer. Apply a minimum of 75 percent 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.

152-3.3 Borrow excavation is not anticipated

152-3.4 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 preparation of embankment areas. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-3.5 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 and compact the embankment to provide surface drainage at all times.

The material in each layer shall be within ±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. Natural drying may be accelerated by blending in a dry material or manipulation alone to increase the rate of evaporation. Samples of excavated materials which will be used in embankment shall be taken by the Engineer for testing to obtain a Moisture-Density Relations of Soils Report (Proctor) in accordance with ASTM D 698D1557. A new Proctor shall be obtained for each soil type based on visual classification. Density tests will be taken by the Engineer for every 10,000 square feet of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the Engineer. 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.

It shall be the Contractor's responsibility to properly place and compact all materials for this project and to correct any deficiencies resulting from insufficient or improper compaction of such materials throughout the Contract period.

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 provided the equipment does not damage the embankment under future paved areas. 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, nor closer than 10 feet horizontally from finished embankment slopes. Density requirements will not apply to portions of embankments constructed of materials which cannot be tested in accordance with specified methods.

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.

152-3.6 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 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 and compacting 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. The subgrade shall be checked for fine grade prior to approval. To check the subgrade for fine grade, the Contractor shall pin and string line the subgrade with a 50 foot grid along straight sections of typical grade. The Contractor shall use a string line placed at a set distance above the required grade. In transition areas and curved sections, Contractor shall pin and string line the subgrade with a 25 foot grid. Alternate methods of checking the fine grade may be used only when authorized by the

Engineer.

Contractor may check fine grade by survey on the approved subgrade prior to placing subbase or base material. The survey shall be along centerline, or ridge lines at 50 foot intervals with elevations taken along sections at 50 foot intervals. In addition, elevations shall be taken at all grade breaks and vertical curves. Contractor shall provide an analysis of the difference in elevations between the survey and proposed grades to the Engineer for approval.

Alternate methods of checking the fine grade may be used only when authorized by the Engineer.

152-3.7 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.

The Contractor's equipment shall not cause damage to any excavated surface, compacted lift or to the subgrade as a result of hauling operations. Any damage caused as a result of the Contractor's hauling operations shall be fully repaired at the Contractor's expense.

Contractor shall be responsible for providing, maintaining and removing any haul roads or routes within or outside of the work area, and shall return the affected areas to their former condition, unless otherwise authorized in writing by the Owner. No separate payment will be made for any work or materials associated with providing, maintaining and removing haul roads or routes.

152-3.8 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 or expected direction of paving operations, it shall not show any deviation in excess of 1/2 inch (12 mm), and shall be within +0 and -1/2 inch (12 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 to specified density.

On all turf areas within the grading limits, the surface shall be of such smoothness that it will not vary more than 0.10 feet (3 mm) 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.

152-3.9 Topsoil. Not Used.

152-3.10 Spoil. All excess material shall be spoiled off airport property.

Prior to placing spoil off airport property, Contractor shall submit a "Spoil Deposition and Release" to the Engineer. A sample form is contained in Specific Airport Operating Requirements of these Specifications and shall be acceptable to the Engineer prior to removing material from the work area.

No direct payment will be made for spoiling operations. The cost of spoiling excess material off-site shall be considered incidental to this Contract and the costs shall be included in the various pay items involved.

152-3.12 Removal of water. The Contractor is responsible for removal of water regardless of its source. Measures shall be taken to protect the excavation from surface water runoff as well as for dewatering the excavation from any water which has entered the excavation. The cost for removal of water shall be considered a subsidiary obligation of the Contractor and included in the contract price for the pay items of work involved.

METHOD OF MEASUREMENT

152-4.1 General. Prior to determination of final quantities, the Engineer will field verify that the Contractor has met grading tolerances. If the final grades are in tolerance and acceptable to the Engineer and Owner, then no adjustments will be made to the neat line quantities.

If the final grades are not in tolerance, but the deviation is acceptable to the Engineer and Owner, then adjustments will be made to the neat line quantities based on a final topographic survey or final cross sections.

If the final grades are not in tolerance and are not acceptable to the Engineer and Owner, then the Contractor shall regrade the areas that are out of tolerance. Upon completion of regrading operations, Engineer will field verify that the Contractor has met grading tolerances as stated above.

152-4.2 Measurement for unclassified excavation shall be the number of cubic yards excavated from its original position based on the calculation of neat line quantities. The neat line quantities were measured by computing the volume based on the comparison of digital terrain model (DTM) surfaces within the payment limits shown on the Contract Drawings. The neat line quantities will be modified to account for authorized additional work. Measurement shall not include the quantity of material excavated without authorization beyond the excavation and embankment limits or the quantity of material used for purposes other than those directed.

The existing grade surface was established by topographic mapping or field cross sections taken for design purposes. The theoretical ground surface after existing pavement is removed is the surface created after existing pavement is excavated and is based on the average depth of pavement to be excavated established by the Engineer for design purposes. After completion of all excavation operations and prior to the placing of base or subbase material, the final excavation will be field verified by the Engineer.

Where finished grade is lower than existing grade, the upper and lower surfaces of the design cross sections or DTM's are those bounded by:

- the theoretical ground surface after pavement excavation and proposed pavement subgrade.

Where finished grade is higher than existing grade, the upper and lower surfaces of the cross section or DTM's are those bounded by:

- the theoretical ground surface after pavement excavation and proposed pavement subgrade.

When the depth of topsoil stripped differs from that used to calculate design quantities, the Engineer will use an agreed upon depth and calculate new neat line quantities for unclassified excavation. The new neat line quantities will be used for payment purposes.

When the depth of pavement excavation differs from that used to calculate design quantities, the Engineer will use an agreed upon depth and calculate new neat line quantities for unclassified excavation. The new neat line quantities will be used for payment purposes.

Topographic mapping or cross sectioning for the exclusive purpose of determining quantities for payment will be employed only where work is ordered outside of excavation and embankment limits. When required, original and final field cross sections will be taken by the Engineer at intervals not exceeding 100 feet.

BASIS OF PAYMENT

152-5.1 "Unclassified excavation" payment shall be made at the contract unit price per cubic yard (cubic meter) for material in its original position. No payment will be made for re-handling of stockpiled

materials. 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-152-5.1 Unclassified Excavation - per cubic yard

SUBMITTALS AND CERTIFICATIONS

152-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- None required.

TESTING REQUIREMENTS

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
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 (2700 kN-m/m^3))
ASTM D 1883	Test Method for Bearing Ratio of Laboratory Compacted Soils (CBR)
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)

MATERIAL REQUIREMENTS

ASTM D 2487 Test Method for Classification of Soils for Engineering Purposes

END OF ITEM P-152

Item P-156 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

156-1.1 This item shall consist of the installation and maintenance of temporary and permanent control measures, and the removal and restoration of temporary control measures as shown on the plans or as ordered by the Engineer during the life of a contract to control water pollution, soil erosion, and siltation, and in accordance with the Storm Water Pollution Prevention Plan (SWPPP) included hereafter as Attachment "A". Control measures shall be maintained throughout the life of this contract or until final stabilization as determined by the Engineer.

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.

MATERIALS

156-2.1 Grass. NOT USED.

156-2.2 Mulches. NOT USED.

156-2.3 Fertilizer. NOT USED.

156-2.4 Silt fence. The silt fence fabric 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 consist of fabric, wood posts and wire support fence meeting the requirements of ASTM D6461.

Fabric shall be recommended by the manufacturer for use as a silt fence and shall have the following properties:

Physical Properties	Requirements	Test Method
Grab Strength for Supported Fence		
Machine Direction	90 lbs. (MARV) for supported fence	ASTM D 4632
X-Machine Direction	90 lbs. (MARV)) for supported fence	ASTM D 4632
Grab Strength for Unsupported Fence		
Machine Direction	125 lbs. (MARV)) for unsupported fence	ASTM D 4632
X-Machine Direction	100 lbs. (MARV)) for unsupported fence	ASTM D 4632
Permittivity	0.05 sec^{-1} (min.)	ASTM D 4491
Apparent Opening Size	#50 U.S. Std. Sieve (max.)	ASTM D 4751
Ultraviolet	70 % (min.) retained strength after 500h	ASTM D 4355

Wood posts shall be of sound quality hardwood with minimum dimensions of 1.2 inches by 1.2 inches by 36 inches long. Supported silt fence shall have a maximum post spacing of 4 feet. Unsupported silt fence

with elongation ≥ 50% shall have a maximum post spacing of 4 feet. Unsupported silt fence with elongation < 50% shall have a maximum post spacing of 2 feet.

Wire fence shall be 14 gauge minimum with maximum 6 inch mesh opening.

156-2.5 Stone filling. NOT USED,

156-2.6 Filter fabric. The filter fabric shall conform to the physical properties listed below. All property values, except apparent opening size, represent the minimum average roll value in the weaker principal direction.

Properties	Test Method	Requirement
Grab Strength	ASTM D 4632	157 pounds (Min.)
Grab Elongation	ASTM D 4632	50% (Min.)
Trapezoid Tear Strength	ASTM D 4533	55 pounds (Min.)
Puncture Strength	ASTM D 6241	309 pounds (Min.)
Permittivity	ASTM D 4491	0.20 sec^{-1} (Min.)
Apparent Opening Size	ASTM D 4751	0.25 mm (No. 60) (max avg. roll value)

156-2.7 Porous backfill. Porous backfill shall be installed in accordance with the details on the Contract Drawings. Porous backfill shall be free of clay, humus, or other objectionable matter, and shall conform to the gradation in Table 1 when tested in accordance with ASTM C 136.

Porous Backfill No. 2	
Sieve Designation (square openings)	Percentage by Weight Passing Sieves
1-1/2 in (38 mm)	100
1 in (25 mm)	90 - 100
3/8 in (9.5 mm)	25 - 60
No. 4 (4.75 mm)	5 - 40
No. 8 (2.36 mm)	0 - 20

156-2.8 Storm water pipes. Storm Sewer Pipe shall conform to the requirements of Item D-701 Pipe for Storm Drains and Culverts.

156-2.9 Lining. Lining shall conform to the requirements of Caltrans Section 26, 3/4" Maximum Aggregate Base Course.

156-2.10 Separation fabric. NOT USED.

156-2.11 Crushed aggregate base course. Crushed aggregate base course shall conform to the requirements of Caltrans Section 26, 3/4" Maximum Aggregate Base Course.

156-2.12 Bituminous concrete pavement. Materials for bituminous concrete pavement shall conform to the requirements of Caltrans Section 39, 1/2" Max. Type A Hot Mix Asphalt.

156-2.13 Straw bales. Bales of straw shall be free from noxious weeds or grasses and shall be securely bound by twine or wire.

156-2.13 Underdrain pipe. NOT USED.

156-2.14 Gravel bags. Bags shall be of the materials and characteristics as specified on the Contract Drawings. Bags shall comply with all requirements as specified in Type SC-6 of the California Stormwater BMP Handbook, Construction Sites, published by the California Stormwater Quality Association (March 2003).

156-2.15 Fiber rolls. Rolls shall be of the materials and characteristics as specified on the Contract Drawings. Rolls shall comply with all requirements as specified in Type SC-5 of the California Stormwater BMP Handbook, Construction Sites, published by the California Stormwater Quality Association (March 2003).

156-2.16 Rip-rap. Rock for designated riparian areas shall conform to the requirements of Caltrans Section 72-2, No. 3 Rock Grading.

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.

A Storm Water Pollution Prevention Plan (SWPPP) is included as part of this specification. Refer to Attachment A.

The Engineer shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

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.

Several methods of controlling dust and other air pollutants include:

Exposing the minimum area of erodible earth.
Applying temporary mulch with or without seeding.
Using water sprinkler trucks.
Using covered haul trucks.
Using dust palliatives or penetration asphalt on haul roads.
Using plastic sheet coverings.

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, and in accordance with Attachment "A" (Storm Water Pollution Prevention Plan). 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 Contractor 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 measures 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 Contractor is responsible for preventing soil erosion and siltation, and for correcting the effects of soil erosion and siltation. The erosion control features installed by the Contractor shall be maintained by the Contractor in a manner acceptable to the Engineer until final stabilization of the disturbed areas. Final stabilization is generally defined as when all soil disturbing activities have been completed and a uniform perennial vegetative cover with a density of 80% for the area has been established. However, removal of soil erosion and siltation control features shall not relieve the Contractor from his obligation to prevent soil erosion and siltation, nor to correct the effects of soil erosion and siltation. Upon removal of temporary erosion and sediment control features, the Contractor shall restore all disturbed areas to a condition equal to or better than original. There will be no separate payment made for restoration of surfaces. The Contractor shall consider the cost of restoration as a subsidiary obligation of performing the work and shall include the costs of restoration in the various pay items involved.

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.

Measures 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. The costs of these items shall be included in the unit price bid for Compliance with Pollution, Erosion, and Siltation Control.

If the Contractor fails to implement and maintain erosion and sediment control practices as required by this Specification, the Owner shall correct the adverse conditions by any means deemed appropriate and shall deduct the cost of the corrective actions from any monies due the Contractor.

Where major nonconformance with the requirements of this specification is noted by the Engineer and compliance is not obtained by the Contractor, all contract work may be stopped by direct order of the Engineer.

156-3.4 National Pollutant Discharge Elimination System (NPDES) Permit and Best Management Plan. The contractor shall be responsible for furnishing all materials, labor and equipment necessary to comply with all National Pollutant Discharge Elimination System (NPDES) requirements for erosion control during construction including the installation of all construction BMP's as shown on the contract documents and the preparation and filing of a Notice of Intent, Inspection and Maintenance Reports and a Notice of Termination. All work and methods shall comply with the best management practices contained in the "California Storm Water Best Management Practice Handbook." And the requirements of the Town of Apple Valley and the San Bernardino County.

This work shall include preparing and revising as necessary a comprehensive stormwater pollution prevention plan, including descriptions of proposed measures to be implemented, a schedule detailing the proposed coordination for accomplishing the erosion control features in a timely and appropriate manner, and site-specific diagrams indicating proposed locations where erosion control devices or measures may be required during successive construction stages.

A. Permit Requirements:

The Contractor shall be designated as permittee. The Contractor shall obtain log-in information and upload the permit application to the State Water Resources Control Board website for **Storm Water Multiple Application and Report Tracking System (SMARTS). The Owner or Legally Responsible Person (LRP) shall set up the project in SMARTS and authorize the Contractor as approved for data entry. The Contractor shall upload the SWPPP as well as any and all other documents and data entries within SMARTS to obtain a Waste Discharger Identification (WDID) number.**

All subcontractors shall comply with the requirements of the NPDES under the supervision of the General Contractor.

The Contractor shall complete the following documents.

1. Stormwater Pollution Prevention Plan (SWPPP) for the Project, including certification of compliance form. The SWPPP must be prepared by a Qualified SWPPP Developer.

2. Notice of Intent (NOI) to be covered by NPDES General Permit, if authorized by the Legally Responsible Person. Contractor shall either submit NOI or notify the County's Stormwater/Wastewater Compliance Specialist, at the County's request.

3. Inspection and Maintenance Reports. The reports must be prepared by a Qualified SWPPP Preparer.

4. Notice of Termination (NOT) of coverage under NPDES General Permit, if authorized by the Legally Responsible Person. Contractor shall either submit NOT or notify the County's Stormwater/Wastewater Compliance Specialist, at the County's request.

The Contractor shall submit the SWPPP to the Engineer for approval at the preconstruction conference. The Contractor shall also transmit preliminary copies of the NOI, as indicated on the NOI form, at the preconstruction conference. Owner or Engineer approval of the SWPPP does not relieve the Contractor of the responsibility to comply with the NPDES permit or other County and State permit requirements. **Regardless of Owner or Engineer approval of the SWPPP, the Contractor shall not disturb any ground until a WDID number is obtained.**

B. Construction Requirements:

The Contractor shall be prepared to implement the SWPPP at the onset of any rainfall, such that construction-related sediment which is generated from stormwater runoff with the Project is eliminated.

The Contractor shall maintain all related construction elements in proper working order, including cleaning and repair. No separate payment will be made for such inspections, cleaning or repair.

The Contractor shall review the SWPPP and revise it as necessary throughout the duration of the contract, in order to assure compliance with the EPA permit requirements. The Contractor shall submit all revisions to the SWPPP to the Engineer for approval prior to implementation.

The Contractor's QSP shall perform weekly and qualifying rainfall event inspections/testing in accordance with the requirements of the SWPPP and/or EPA and document the findings.

The Engineer will inspect the condition of all measures listed in SWPPP. The Contractor shall provide the Engineer with all documents in accordance with the record keeping requirements of the EPA.

All SWPPP reports required under this contract shall be available to the public in accordance with the requirements of section 308(b) of the Clean Water Act.

No condition of the SWPPP shall release the Contractor from any responsibilities or requirements under other environmental statutes or regulations.

The final SWPPP shall be kept on the Project site at all times, and shall be retained by the permittee for three years following the final acceptance. Upon final stabilization of the construction site, and demobilization, the contractor shall submit his completed signed NOT form to the EPA, with copies to the Engineer, and Agencies who received a copy of NOI, thereby terminating all NPDES permit coverage for the Project.

METHOD OF MEASUREMENT

156-4.1 Measures and practices required for compliance with this specification for protection of construction areas outside the construction limits shall be measured on a lump sum basis. Measures and practices shall include, but not be limited to, air pollution prevention, water pollution prevention, temporary seeding, temporary mulching, construction road stabilization, dust control, protecting vegetation, and erosion and sediment control practices required due to the Contractor's means and methods of construction, and for borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites.

Compliance with Pollution, Erosion, and Siltation Control shall also include the development and submittal of a SWPPP which will be included as Attachment "A" to this specification.

156-4.2 The quantity of gravel bag berm to be paid for shall be the number of linear feet of each unit installed, measured along its centerline, installed, completed, in place and accepted as satisfactory by the Engineer.

156-4.3 The quantity of stabilized construction entrance to be paid for shall be the number of each type of unit installed, completed, in place and accepted as satisfactory by the Engineer.

BASIS OF PAYMENT

156-5.1 Payment will be made at the lump sum bid price for compliance with pollution, erosion, and siltation control. The lump sum price bid shall include the cost of all labor, material, equipment and all incidentals necessary to complete this item. Partial payments may be made at the discretion of the Engineer as the work progresses, based on contract time or percent work complete.

The lump sum price bid shall include the cost of developing and submitting a SWPPP, NOI, NOT and all labor, material, equipment and all incidentals necessary to complete this item. All SMARTS permit and application fees and any other costs associated with filing and closing the SWPPP shall be the responsibility of the Contractor. Any fines that are assessed to the Owner or LRP due to non-compliance with the SWPPP or NPDES requirements, shall be the responsibility of the Contractor and deducted from the Contractor's next progress payment.

156-5.2 Payment will be made at the contract unit price per linear foot for gravel bag berm installed as designated on the Contract Drawings or as directed by the Engineer. These prices shall be full compensation for furnishing all materials and for all preparation, hauling, maintenance, installation, replacement, removal, restoration, and off-site disposal of these materials and for all labor, equipment, tools and incidentals necessary to complete the item. No separate or additional payment shall be made for maintenance or replacement of these items.

156-5.3 Payment will be made at the contract unit price per each for stabilized construction entrance installed as designated on the Contract Drawings or as directed by the Engineer. These prices shall be full compensation for furnishing all materials and for all preparation, hauling, maintenance, installation, replacement, removal, restoration, and off-site disposal of these materials and for all labor, equipment, tools and incidentals necessary to complete the item. No separate or additional payment shall be made for maintenance or replacement of these items.

Payment will be made under:

Item P-156-5.1	Compliance with Pollution, Erosion, and Siltation Control – per lump sum
Item P-156-5.2	Stabilized Construction Entrance - per each
Item P-156-5.3	Rip Rap, No. 3 Rock - per cubic yard

SUBMITTALS AND CERTIFICATIONS

156-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Catalog data and certification showing that materials to be supplied meet the requirements specified.

MATERIAL REQUIREMENTS

ASTM D6461	Standard Specification for Silt Fence Materials
AC 150/5200-33	Hazardous Wildlife Attractants

END OF ITEM P-156

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 quality requirements. 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 meets 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 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.

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.

Sieve Size	Design Range Percentage by Weight	Contractor's Final Gradation	Job Control Grading Band Tolerances for Contractor's Final gradation Percent
2 inch (50 mm)	100		0
1-1/2 inch (38 mm)	95-100		±5
1 inch (25 mm)	70-95		±8
3/4 inch (19 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40 (0.45 mm)	10-30		±5
No. 200 (0.075 mm)	0-8 (see Note 1)		±3

Note 1: 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 "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.

209-2.3 Sampling and testing. Prior to the start of production, Contractor shall submit to the Engineer, certified test results showing that the aggregate meets the quality requirements and gradation requirements of this section.

At the discretion of the Engineer, the aggregates may be tested for compliance with the quality requirements of this specification prior to the start of and during production. The sampling points and intervals will be determined by the Engineer. Contractor shall make material available to the Engineer for compliance testing. All tests necessary to determine compliance with the specification requirements will be made by the Engineer at no expense to the Contractor. All re-testing required due to failing test results shall be at the expense of the Contractor.

During production, aggregate which is not stockpiled shall be tested for compliance with gradation requirements at least once daily. Sampling shall be performed at the flowing aggregate stream (bins or belt discharge) or conveyor belt in accordance with ASTM D-75. Testing shall be in accordance with ASTM C-117 and C-136.

In lieu of daily testing for Gradation Requirements, Contractor may elect to place aggregate in stockpiles prior to transporting to the project site. Construction and sampling of stockpiles shall be in accordance with ASTM D-75. The maximum stockpile size shall not exceed 4,000 c.y unless authorized by the Engineer. Testing shall be in accordance with ASTM C-117 and C-136. A stockpile shall be considered acceptable for transportation to the project site when the samples tested meet the Gradation Requirements.

At least two weeks prior to the start of production, the Contractor shall inform the Engineer of the methods which are proposed for providing aggregate to the project site so that arrangements can be made for sampling and testing aggregates.

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 at the Contractor's expense. 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.

Special consideration shall be given to crushed aggregate base course material which is not obtained from a stockpile. Any crushed aggregated base material placed on a day's production which does not meet the Gradation Requirements shall be removed at no expense to the Owner. When constructing multiple lifts, no layer shall be covered by subsequent layers until test results verify that Gradation Requirements have been met.

209-3.4 Compaction. Immediately after 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 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 D 698.

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) per lift. 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) per lift. The Engineer shall perform all density tests.

Each lot shall be divided into two equal sublots. One density test shall be made for each sublot and density for the lot shall consist of the average of the 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 D 698.. The in-place field density shall be determined per ASTM D1556, the Sand Cone Method (Test in accordance with ASTM D4718 if greater than 30% is retained on the 3/4 inch sieve), ASTM D2167 the Rubber Balloon Method, or ASTM D6938, the Nuclear Gage Method using Procedure A, the direct transmission method. If density is determined using ASTM D6938, then 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 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.

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. The Contractor shall use a string line placed at a set distance above the required grade. The Contractor shall pin and string line the surface with a 50-foot grid along straight sections of typical grade. In transition areas and curved sections, Contractor shall pin and string line the surface with a 25-foot grid. Measurements will be taken by the Engineer.

Contractor may check grade and crown by survey provided a survey is performed on the approved subgrade/subbase prior to placing base material. The survey shall be along centerline, or ridge lines at 50 foot intervals with elevations taken along sections at 50 foot intervals. In addition, elevations shall be taken at all grade breaks and vertical curves. Contractor shall survey the finished surface of the base course at the same locations that the survey was taken on the subgrade/subbase. Contractor shall provide an analysis of the difference in elevations between the two surveys to the Engineer for approval.

Alternate methods of checking the fine grade may be used only when authorized by the Engineer.

209-3.7 (Section not used.)

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. 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. Areas disturbed by the removal of survey and grade hubs shall be filled, if necessary, and re-compacted to create a smooth finished surface.

209-3.10 Removal of water. The Contractor is responsible for removal of water regardless of its source. Measures shall be taken to protect the excavation from surface water runoff as well as for dewatering the excavation from any water which has entered the excavation. The cost of the removal of water shall be considered as a subsidiary obligation of the Contractor and included in the contract price for the pay items of work involved.

METHOD OF MEASUREMENT

209-4.1 The quantity of crushed aggregate base course will be determined by measurement of the number of cubic yards 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 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

SUBMITTALS AND CERTIFICATIONS

209-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Certified test results for wear (L.A. Abrasion).
- Certified test results for sodium sulfate soundness loss or magnesium sulfate soundness loss.
- Certified test results for flat or elongated particles.
- Certified test results for fractured faces.
- Gradation Sieve Analysis.

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 C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
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/ft^3 (600 kN-m/m^3))

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 (2700 kN-m/m^3))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
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

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.

401-1.2 Prior to disturbing original grade, Contractor shall verify the accuracy of existing elevations by verifying spot elevations at the same locations where original field survey data was obtained in accordance with Item M-150, SURVEY & STAKEOUT.

MATERIALS

401-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, screenings, 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.

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 50 percent by weight of individual pieces having two or more fractured faces and 65 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.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, 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.

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler. The Contractor shall furnish documentation to the Engineer confirming that all aggregate proposed for use meets the requirements specified herein. When deemed necessary by the Engineer, the Contractor shall furnish aggregate samples to the Engineer for testing by him to verify compliance with the requirements specified herein. Sampling of the aggregates will be observed and monitored by the Engineer. Initial tests by the Engineer will be at no expense to the Contractor. Costs for testing additional sources shall be borne by the Contractor. No aggregate shall be used in the production of mixtures without prior approval.

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 70-10) . A certificate of compliance from the manufacturer shall be included with the mix design submittal.

The supplier's certified test report with test data indicating grade certification for the asphalt binder shall be provided to the Engineer for each load at the time of delivery to the mix plant. A certified test report with test data indicating grade certification for the asphalt binder shall also be provided to the Engineer for any modification of the asphalt binder after delivery to the mix plant and before use in the HMA.

401-2.4 Preliminary material acceptance. Prior to delivery of materials to the job site, the Contractor shall submit certified test reports to the Engineer for the following materials:

a. Coarse aggregate:

(1) Percent of wear

(2) Soundness

(3) Clay lumps and friable particles

(4) Percent fractured faces

(5) Flat and elongated particles

b. Fine aggregate:

(1) Liquid limit and Plasticity index

(2) Soundness

(3) Clay lumps and friable particles

(4) Percent natural sand

(5) Sand equivalent

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.

401-2.5 Anti-stripping agent. Any anti-stripping agent or additive if required shall be heat stable, shall not change the asphalt cement viscosity beyond specifications, shall contain no harmful ingredients, shall be added in recommended proportion by approved method, and shall be a material approved by the Department of Transportation of the State in which the project is located.

401-2.6 Joint sealant, backer rod and backup material. Joint sealant, backer rod and backup material shall be in accordance with Item P-605.

401-2.7 Pavement sealer. Pavement sealer shall be a high quality asphalt pavement sealer with a filled sealer formula. Sealer shall have at least a 5 year warranty.

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 Asphalt Institute MS-2 Mix Design Manual, 7th Edition. ASTM D6926 shall be used for preparation of specimens using the manually held and operated hammer for the mix design procedure. ASTM D6927 shall be used for testing for Marshall stability and flow.

If material variability exceeds the standard deviations indicated, the JMF and subsequent production targets shall be based on a stability greater than shown in Table 1 and the flow shall be targeted close to the mid-range of the criteria in order to meet the acceptance requirements.

The design criteria in Table 1 are target values necessary to meet the acceptance requirements contained in paragraph 401-5.2b. The criteria are based on a production process which has a material variability with the following standard deviations: Stability = 270 lbs (1200 N); Flow (0.01 inch (0.25 mm)) = 0.015 inches (.38 mm); Air Voids = 0.65%.

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 30 days prior to the start of paving operations. The JMF shall be developed within the same construction season using aggregates currently being produced, or the Contractor shall certify that the source and characteristics of aggregates used in the JMF are the same as those currently being produced.

The submitted JMF shall be signed by the person responsible for preparing 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 blows per side of molded specimen.

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 stability, flow, air voids, voids in the mineral aggregate, 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 and do not certify that the source and characteristics of aggregates used in the JMF are the same as those currently being produced shall not be accepted.

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, including a new test strip when required by the Engineer, 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 Marshall Design Criteria applicable to the project shall meet the criteria specified in Table 1.

Table 1. Marshall Design Criteria

Test Property	Pavements Designed for Aircraft Gross Weights Less Than 60,000 Lbs (27216 kg) or Tire Pressures Less Than 100 psi
Number of blows	50
Stability, pounds (Newtons) minimum	1350 (6000)
Flow[1], 0.01 in. (0.25 mm)	10-18
Air voids (%)	3.5
Percent voids in mineral aggregate, minimum	See Table 2

[1] The upper flow requirement is not applicable for Polymer Modified Asphalts.

Table 2. Minimum Percent Voids In Mineral Aggregate (VMA)

Aggregate (See Table 3)	Minimum VMA
Gradation 3	16%
Gradation 2	15%
Gradation 1	14%

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

Sieve Size	Percentage by Weight Passing Sieves		
	Gradation 1 1" max.	**Gradation 2** 3/4" max.	**Gradation 3** 1/2" max.
1 inch (25 mm)	100	--	--
3/4 inch (19 mm)	76-98	100	--
1/2 inch (12 mm)	66-86	79-99	100
3/8 inch (9 mm)	57-77	68-88	79-99
No. 4 (4.75 mm)	40-60	48-68	58-78
No. 8 (2.36 mm)	26-46	33-53	39-59
No. 16 (1.18 mm)	17-37	20-40	26-46
No. 30 (0.600 mm)	11-27	14-30	19-35
No. 50 (0.300 mm)	7-19	9-21	12-24
No. 100 (0.150 mm)	6-16	6-16	7-17
No. 200 (0.075 mm)	3-6	3-6	3-6
Asphalt Percent based on Weight of Total Mix:			
Stone or gravel	4.5-7.0	5.0-7.5	5.5-8.0
Slag	5.0-7.5	6.5-9.5	7.0-10.5

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute 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 start of construction.

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 50 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 sawcut 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 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) stability, flow, 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.

If the initial test section meets specification requirements and is accepted in writing by the Engineer, full production may begin.

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.

If the initial test section does not meet specification requirements and the second test section meets specification requirements, then the initial test section will be allowed to remain in place if it does not fall below the rejection limit as described in paragraph 401-8.1. Test sections which are allowed to remain in place shall be paid for 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 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)	
	°F	°C
3 inches (7.5 cm) or greater	40	4
Greater than 2 inches (50 mm) but less than 3 inches (7.5 cm)	45	7

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 changes noted below. The Contractor must submit evidence that the plant is currently certified in accordance with AASHTO before the start of plant production.

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 listed below.

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.

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 testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

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 are not required.

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 be capable of paving to a width of 25 feet. 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.

Contractor shall provide a 12-foot straightedge. Straightedge shall be box aluminum approximately 2" x 4" and shall be available to the Engineer during all paving operations.

401-4.4.1 Automatic grade controls. The HMA paver shall be equipped with a longitudinal and transverse grade control system capable of automatically maintaining the specified screed elevation. On pavers with a screed width greater than 17 feet, controls that operate from references on both sides of the paver shall be provided. 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. No separate payment will be made for supplying the density gauge 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 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. Prior to placing the HMA on existing pavement, the underlying course shall be cleaned and prepared in accordance with Item P-101, Surface Preparation. Immediately before placing the HMA, the underlying course shall be cleaned of all dust and debris. Prior to placing the bituminous mixture on existing pavement, the Contractor shall apply a tack coat meeting the requirements of Item P-603. The Contractor shall apply tack coat between each lift, unless otherwise directed by the Engineer.

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 a sketch, the sequence of paving laydown by stations (length of pulls), width of lanes, directions of pulls, thickness of each lift, 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. Unless otherwise shown or noted, deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's production can be completed during daylight hours.

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. Artificial means of cooling are not allowed. No lift shall be placed on top of previously placed bituminous mixture on the same day unless otherwise approved by the Engineer.

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. If grades are out of tolerance, the Contractor shall use reference lines for subsequent lifts. Corrective action in paragraph 401-5.2b(6) applies to the final lift of surface course. However, for multiple lift construction, the Contractor shall make corrections to ensure the final lift of pavement is within the laydown thicknesses shown below.

Setting grade stakes and reference lines includes establishing all of the conditions necessary for the reference line to adequately serve for grade referencing. The factors include but are not limited to:

a. Setting grade stakes away from the mat edge an additional distance to compensate for the extended distance of the wire from the stake. The reference line shall be mounted on sensor brackets every 25 feet on straight sections.

b. Setting the reference line at an established height, or relative height above finished grade.

c. Reference line shall be taut and anchored at both ends of the wire to reduce sagging. The reference line shall extend onto the existing pavement, or the previous mat, at least 50 feet prior to pullout, so that the paver begins running on automation.

d. Additional anchors laid out in chords shall be used along curved sections to assist in keeping the reference line attached to the cross arm of the grade stake. Chord length will be dependent on the radius of the curve. The shorter radius curves shall use closer spacing of sensor brackets.

e. Reference line shall be set as low as practical to help avoid disturbance by workers.

Laydown thicknesses shall be such that the compacted lifts fall within the following range, unless otherwise approved:

Mix Type	**Min. Lift**	**Max. Lift**
Gradation 1	2”	4”
Gradation 2	1-1/2”	3”
Gradation 3	1”	2”

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 25 feet except where edge lanes require less width to complete the area. Additional screed sections shall not be attached to widen paver to meet the minimum lane width requirements specified above unless additional auger sections are added to match. Additional screed sections shall be made by the same manufacturer as the main screed, they shall be vibratory and provided with heating units.

The longitudinal joint in one lift shall offset the longitudinal joint in the lift immediately below by at least 1 foot (30 cm); however, the joint in the surface top course shall be at the centerline of crowned pavements. The joint at the centerline of crowned pavements shall line up with previous lift centerline joints.

Transverse joints in one lift shall line up with transverse joints in the previous lifts unless otherwise approved by the Engineer. Transverse joints in adjacent lanes shall line up with each other extending across the full width of the pavement. Upon completion of paving operations, transverse joints shall be sawed and sealed in accordance with the Contract Drawings and as directed by the Engineer. If approved by the Engineer in special cases, transverse joints in one lift shall be offset by at least 10 feet from transverse joints in the previous lift and transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the 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 expense. The area shall be removed by saw cutting and milling a minimum of 2 inches (50 mm) deep. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet (3 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 all roller marks are eliminated, 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. A small amount of detergent or water soluble oil may be permitted in the water used.

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. Tampers shall only be used in areas approved by the Engineer.

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 surface temperature has cooled to less than 175°F (80°C**)**; or are irregular, damaged, uncompacted or otherwise defective shall be sawcut back a minimum of 6 inches (150 mm) to expose a clean, sound, uniform vertical surface for the full depth of the lift. The sawcut shall not be performed until the pavement has reached ambient temperature. 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 shall be considered incidental to the cost of the HMA. In general, the Contractor shall not pave a distance to exceed ten times the ambient temperature, unless otherwise directed by the Engineer.

The Contractor may provide additional joint density quality control by use of joint heaters at the Contractor's expense. Electrically powered infrared heating equipment should consist of one or more low-level radiant energy heaters to uniformly heat and soften the pavement joints. The heaters should be configured to uniformly heat an area up to 18 inches (0.5 m) in width and 3 inches (75 mm) in depth. Infrared equipment shall be thermostatically controlled to provide a uniform, consistent temperature increase throughout the layer being heated up to a maximum temperature range of 200 to 300°F (93 to 150°C).

Propane powered infrared heating equipment shall be attached to the paving machine and the output of infrared energy shall be in the one to six micron range. Converters shall be arranged end to end directly over the joint to be heated in sufficient numbers to continuously produce, when in operation, a minimum of 240,000 BTU per hour. The joint heater shall be positioned not more than one inch (25 mm) above the pavement to be heated and in front of the paver screed and shall be fully adjustable. Heaters will be required to be in operation at all times.

The heaters shall be operated so they do not produce excessive heat when the units pass over new or previously paved material.

Upon completion of paving operations, all transverse paving joints, all joints between existing pavement and new pavement, and new joints in the final surface at locations shown on the Contract Drawings shall be saw cut and sealed in accordance with the Contract Drawings and as directed by the Engineer. Joint sealing shall be performed in accordance with Item P-605, Joint Sealing Filler. Cost for saw cutting and sealing joints in proposed pavement shall be included in the bid price per ton of asphalt. No separate measurement or payment shall be made for this work.

401-4.14 Saw-cut grooving. Saw cut grooves are not required for this project.

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 pavement sealer 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. No paving or rolling will be allowed at night.

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 as required in this section shall be completed and paid for by the Contractor.

Testing organizations performing these tests 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 operations at the Contractor's expense.

a. Hot mixed asphalt. Plant-produced HMA shall be tested for air voids, stability and flow 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 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).

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. When absorptive aggregates are used, the sample of bituminous mixture may be put in a covered metal tin and placed in an oven for not less than 60 minutes nor more than 90 minutes to stabilize to compaction temperature. The compaction temperature of the specimens shall be as specified in the JMF.

(2) Testing. Sample specimens shall be tested for stability and flow in accordance with ASTM D6927. 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 D6926 at the

number of blows 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. The manual hammer in ASTM D6926 shall be used.

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, Type C, D or E container. Samples shall be taken on a random basis in accordance with ASTM D 3665.The value used in the air voids computation for each sublot shall be based on theoretical maximum specific gravity measurement for the sublot.

The stability and flow for each sublot shall be computed by averaging the results of all test specimens representing that sublot.

(3) Acceptance. Acceptance of plant produced HMA for stability, flow, and 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 or closer than 2 feet from a pavement edge.

(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. Longitudinal joints are those which are formed by two paving lanes. 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. Contractor shall apply tack coat to all surfaces prior to filling holes. The Contractor is responsible for delivering the cores to the Bituminous Mixing Plant's testing facilities for testing by the Engineer.

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 using the procedure for thoroughly dry specimens. 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, unless a sample has already been taken for that sublot. 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.

d. Undersized Lots. When agreed to by the Engineer and the Contractor, minor productions of material may be sampled as one sublot and its properties will be considered representative of the sublot from which it was taken. The sublot will be handled as a partial lot as described above.

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

(7) Stability

(8) Flow

Mat density and air voids will be evaluated for acceptance in accordance with paragraph 401-5.2b(1). Stability and flow will be evaluated for acceptance in accordance with paragraph 401-5.2b(2). Joint density will be evaluated for acceptance in accordance with paragraph 401-5.2b(3).

Thickness will be evaluated by the Engineer for compliance in accordance with paragraph 401-5.2b(4). Acceptance for smoothness will be based on the criteria contained in paragraph 401-5.2b(5). Acceptance for grade will be based on the criteria contained in paragraph 401-5.2b(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.

(2) Stability and flow. Acceptance of each lot of plant produced HMA for stability and flow shall be based on the PWL. If the PWL of the lot equals or exceeds 90%, the lot shall be acceptable. If the PWL is less than 90%, the Contractor shall determine the reason and take corrective action. If the PWL is below 80%, the Contractor must stop production until the reason for poor stability and/or flow has been determined and adjustments to the HMA are made. Consecutive lots with PWL below 80 percent for stability or flow values shall be removed and replaced at the expense of the Contractor.

(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 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 HMA 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 finished surface course of the pavement shall not vary more than 1/4 inch (6mm) when evaluated with a 12-foot (3.7m) straightedge. When the finished 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 sublot in which they occur. Tack coat shall be applied to all surfaces prior to replacement. Diamond grinding shall be in accordance with paragraph 401-4.15. Corrections involving diamond grinding will be subject to the final pavement thickness tolerances specified. The Contractor shall apply a pavement sealer 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 days 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). 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.

Price adjustments in accordance with the requirements of paragraph 401-8.1.d for pavement smoothness do not apply to smoothness testing for the full length of runway.

(6) Grade. Grade shall be evaluated on the first day of placement and then as a minimum, every lift 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 50 feet (15 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 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 (1,650 m^2). 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 lift plus 1/2 inch (12 mm) of pavement and replace with new material. Tack coat shall be applied to all surfaces prior to placement. 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. Diamond grinding shall be in accordance with paragraph 401-4.15. 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 m^2). Areas in excess of 15 square yards (12.5 m^2) will require removal and replacement of the pavement in accordance with the limitations noted above. The Contractor shall apply a pavement sealer 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 the Project's Front Ends. The specification tolerance limits (L) for lower and (U) for upper are contained in Table 5.

Table 5. Marshall acceptance limits for stability, flow, air voids, density

TEST PROPERTY	Pavements Designed for Aircraft Gross Weights Less Than 60,000 lbs (27216 kg) or Tire Pressures Less Than 100 psi	
Number of Blows	50 blows	
	Specification Tolerance Limits	
	L	**U**
Stability, minimum (lbs)	1000	--
Flow, 0.01-in	8	20*

TEST PROPERTY	Pavements Designed for Aircraft Gross Weights Less Than 60,000 lbs (27216 kg) or Tire Pressures Less Than 100 psi	
Air Voids Total Mix (%)	2	5
Surface Course Mat Density (%)	96.3	--
Base Course Mat Density (%)	95.5	--
Joint density (%)	93.3	--

* Upper flow limit requirements do not apply for any mix with a polymer-modified binder (where the difference between the upper and lower temperature number is 90°F (32°C) or greater).

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 and 401-5.2b(2) for stability and flow, 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 paragraph 401-4.11. The leveling course is the first variable thickness lift of an overlay placed prior to subsequent courses.

Prior to the daily placement of the leveling course, the Contractor shall have his proposed laydown and rolling plan approved in writing by the Engineer. The plan shall indicate:

a. Initial laydown temperature of the material.

b. The wheel load and tire pressure of the pneumatic roller.

c. The number of passes by each piece of equipment.

d. The minimum temperature of the material upon completion (not less than 175^0F).

Compacted thicknesses of bituminous mixtures used for leveling course shall be in accordance with paragraph 401-4.10. Multiple lifts of leveling course may need to be placed to obtain the proper grade.

When placing the leveling course, Contractor shall provide grade control as required in paragraph 401-4.10.

The Contractor shall furnish a nuclear gauge and operator to monitor densification of the leveling course.

If undue displacement, cracking or shoving of the material occurs or if maximum densification of the material is not achieved, the Contractor shall remove the material placed as directed by the Engineer. Contractor shall modify his procedure, and place a new leveling course at his own expense.

CONTRACTOR QUALITY CONTROL

401-6.1 General. The Contractor shall develop a Quality Control Program in accordance with the Project's Front End. The program shall address all elements that affect the quality of the pavement including, but not limited to:

a. Mix design

b. Aggregate grading

c. Quality of materials

d. Stockpile management

e. Proportioning

f. Mixing and transportation

g. Placing and finishing

h. Joints

i. Compaction

j. Surface smoothness

k. Personnel

l. Laydown plan

The Contractor shall perform quality control sampling, testing, and inspection during all phases of the work and shall perform them at a rate sufficient to ensure that the work conforms to the contract requirements, and at minimum test frequencies required by paragraph 401-6.3 and in the Project's Front End. As a part of the process for approving the Contractor's plan, the Engineer may require the Contractor's technician to perform testing of samples to demonstrate an acceptable level of performance.

No partial payment will be made for materials that are subject to specific quality control requirements without an approved plan.

401-6.2 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.

(1) 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.

(2) Printed plant tickets. Printed plant tickets are acceptable for determining the asphalt content during production only if the Asphalt Content was reported on the JMF as a percent by weight of total mixture.

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. When asphalt content is determined by printed plant tickets, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix or continuous mix plants, and tested in accordance with ASTM C 136 (dry sieve) using actual batch weights to determine the combined aggregate gradation of the mixture.

c. Moisture content of aggregate. The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM 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		
Sieve	**Action Limit**	**Suspension Limit**
3/4 inch (19 mm)	±6%	±9%
1/2 inch (12 mm)	±6%	±9%
3/8 inch (9 mm)	±6%	±9%
No. 4 (4.75 mm)	±6%	±9%
No. 16 (1.18 mm)	±5%	±7.5%
No. 50 (0.30 mm)	±3%	±4.5%
No. 200 (0.075 mm)	±2%	±3%
Asphalt Content	±0.45%	±0.70%
VMA	-1.00%	-1.50%

b. Range. Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

Control Chart Limits Based On Range (Based On n = 2)	
Sieve	**Suspension Limit**
1/2 inch (12 mm)	11%
3/8 inch (9 mm)	11%
No. 4 (4.75 mm)	11%

Control Chart Limits Based On Range (Based On n = 2)	
Sieve	**Suspension Limit**
No. 16 (1.18 mm)	9%
No. 50 (0.30 mm)	6%
No. 200 (0.075 mm)	3.5%
Asphalt Content	0.8%

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 the Project's Front End.

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 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%.

Payment in excess of 100% for accepted lots of bituminous concrete pavement shall not be used to offset the payment reduction for a rejected lot that is allowed to remain in place.

Payment in excess of 100% for accepted lots of bituminous concrete pavement for any particular pay item shall not be used to offset payment reductions for accepted lots of bituminous concrete pavement from any other particular pay item.

Table 6. Price adjustment schedule[1]

Percentage of material within specification limits (PWL)	Lot pay factor (percent of contract unit price)
96 – 100	106
90 – 95	PWL + 10
75 – 89	0.5 PWL + 55
55 – 74	1.4 PWL – 12
Below 55	Reject [2]

[1] Although it is theoretically possible to achieve a pay factor of 106% 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.

Payment will be made under:

Item P-401-8.1 Bituminous Surface Course, Gradation 1 - per ton

SUBMITTALS AND CERTIFICATIONS

401-9.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Certified test results for Coarse Aggregate wear.
- Certified test results for Coarse Aggregate sodium sulfate soundness loss or magnesium sulfate soundness loss.
- Certified test results for Coarse Aggregate clay lumps and friable particles.
- Certified test results for Coarse Aggregate fractured faces.
- Certified test results for Coarse Aggregate flat and elongated particles.
- Certified test results for Fine Aggregate plasticity index and liquid limit.
- Certified test results for Fine Aggregate sodium sulfate soundness loss or magnesium sulfate soundness loss.

- Certified test results for Fine Aggregate clay lumps and friable particles.
- Certified test results for Fine Aggregate natural sand.
- Certified test results for Fine Aggregate natural sand plasticity index and liquid limit.
- Certified test results for Fine Aggregate sand equivalent.
- Certification that mineral filler meets the requirements specified.
- Certification that asphalt cement binder meets the requirements specified.
- Certification that the anti-stripping agent meets the requirements specified.
- Submittal for joint sealant, backer rod and back-up material per Item P-605.
- Job Mix Formula in accordance with the Asphalt Institute's Manual Series No. 2 for each bituminous mix developed.
- Contractor's Quality Control Plan.
- Certification that the bituminous plant meets the requirements specified.
- Certification that plant testing laboratory meets the requirements specified.

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 C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
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 D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
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 D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
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 D6084	Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer
ASTM D6307	Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D6752	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method
ASTM D6926	Standard Practice for Preparation of Bituminous Specimens Using Marshall Apparatus
ASTM D6927	Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph

AASHTO T030	Standard Method of Test for Mechanical Analysis of Extracted Aggregate
AASHTO T110	Standard Method of Test for Moisture or Volatile Distillates in Hot Mix Asphalt (HMA)
AASHTO T275	Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Paraffin-Coated Specimens
AASHTO M156	Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
AASHTO T329	Standard Method of Test for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method
Asphalt Institute Handbook MS-26,	Asphalt Binder
Asphalt Institute MS-2	Mix Design Manual, 7th Edition

MATERIAL REQUIREMENTS

ASTM D242	Standard Specification for Mineral Filler for Bituminous Paving Mixtures
ASTM D946	Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D3381	Standard Specification for Viscosity-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

END OF ITEM P-401

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 shown in Table 1 and indicated in ASTM D3628 as a bituminous application for tack coat appropriate to local conditions.

Table 1 Bituminous Material

Type and Grade	Specification	Application Temperatures	
		Deg. F	Deg. C
Emulsified Asphalt			
MS-1	ASTM D 977	70-160	20-70
HFMS-1	ASTM D 977	70-160	20-70
SS-1	ASTM D 977	70-160	20-70
SS-1h	ASTM D 977	70-160	20-70
CSS-1	ASTM D 2397	70-160	20-70
CSS-1h	ASTM D 2397	70-160	20-70

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 building paper 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.

The application rate for Emulsified Asphalt shall be as follows:

Surface Type	Application Rate (Gal/SY)
New Hot Mix Asphalt	0.031 – 0.040
Milled Surfaces	0.046 – 0.055
Existing Hot Mix Asphalt	0.046 – 0.055
Portland Cement Concrete	0.037 – 0.066
Vertical Surfaces (including curbs, concrete drainage structures and appurtenances)	0.059 – 0.070

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.

Tack coat used for construction of a test section will only be included in payment if the test section is allowed to remain in place.

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 square yard.

BASIS OF PAYMENT

603.5-1 Payment shall be made at the contract unit price per gallon 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

SUBMITTALS AND CERTIFICATIONS

603-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Submittal for bituminous material identifying material and showing that it meets the requirements specified.

MATERIAL REQUIREMENTS

ASTM D633	Standard Volume Correction Table for Road Tar
ASTM D977	Standard Specification for Emulsified Asphalt
ASTM D1250	Standard Guide for Use of the Petroleum Measurement Tables
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

TABLE IV-3 TEMPERATURE-VOLUME CORRECTIONS FOR EMULSIFIED ASPHALTS

°C	°F	*M	°C	°F	*M	°C	°F	*M	°C	°F	*M	°C	°F	*M
10.0	50	1.00250	20.0	68	0.99800	30.0	86	0.99350	40.0	104	0.98900	50.0	122	0.98450
10.6	51	1.00225	20.6	69	0.99775	30.6	87	0.99325	40.6	105	0.98875	50.6	123	0.98425
11.1	52	1.00200	21.1	70	0.99750	31.1	88	0.99300	41.1	106	0.98850	51.1	124	0.98400
11.7	53	1.00175	21.7	71	0.99725	31.7	89	0.99275	41.7	107	0.98825	51.7	125	0.98375
12.2	54	1.00150	22.2	72	0.99700	32.2	90	0.99250	42.2	108	0.98800	52.2	126	0.98350
12.8	55	1.00125	22.8	73	0.99675	32.8	91	0.99225	42.8	109	0.98775	52.8	127	0.98325
13.3	56	1.00100	23.3	74	0.99650	33.3	92	0.99200	43.3	110	0.98750	53.3	128	0.98300
13.9	57	1.00075	23.9	75	0.99625	33.9	93	0.99175	43.9	111	0.98725	53.9	129	0.98275
14.4	58	1.00050	24.4	76	0.99600	34.4	94	0.99150	44.4	112	0.98700	54.4	130	0.98250
15.0	59	1.00025	25.0	77	0.99575	35.0	95	0.99125	45.0	113	0.98675	55.0	131	0.98225
15.6	60	1.00000	25.6	78	0.99550	35.6	96	0.99100	45.6	114	0.98650	55.6	132	0.98200
16.1	61	0.99975	26.1	79	0.99525	36.1	97	0.99075	46.1	115	0.98625	56.1	133	0.98175
16.7	62	0.99950	26.7	80	0.99500	36.7	98	0.99050	46.7	116	0.98600	56.7	134	0.98150
17.2	63	0.99925	27.2	81	0.99475	37.2	99	0.99025	47.2	117	0.98575	57.2	135	0.98125
17.8	64	0.99900	27.8	82	0.99450	37.8	100	0.99000	47.8	118	0.98550	57.8	136	0.98100
18.3	65	0.99875	28.3	83	0.99425	38.3	101	0.98975	48.3	119	0.98525	58.3	137	0.98075
18.9	66	0.99850	28.9	84	0.99400	38.9	102	0.98950	48.9	120	0.98500	58.9	138	0.98050
19.4	67	0.99825	29.4	85	0.99375	39.4	103	0.98925	49.4	121	0.98475	59.4	139	0.98025

TABLE IV-3 TEMPERATURE-VOLUME CORRECTIONS FOR EMULSIFIED ASPHALTS

°C	°F	*M	°C	°F	*M	°C	°F	*M	°C	°F	*M	°C	°F	*M
60.0	140	0.98000	68.3	155	0.97625	76.7	170	0.97250						
60.6	141	0.97975	68.9	156	0.97600	77.2	171	0.97225						
61.1	142	0.97950	69.4	157	0.97575	77.8	172	0.97200						
61.7	143	0.97925	70.0	158	0.97550	78.3	173	0.97175						
62.2	144	0.97900	70.6	159	0.97525	78.9	174	0.97150						
62.8	145	0.97875	71.1	160	0.97500	79.4	175	0.97125						
63.3	146	0.97850	71.7	161	0.97475	80.0	176	0.97100						
63.9	147	0.97825	72.2	162	0.97450	80.6	177	0.97075						
64.4	148	0.97800	72.8	163	0.97425	81.1	178	0.97050						
65.0	149	0.97775	73.3	164	0.97400	81.7	179	0.97025						
65.6	150	0.97750	73.9	165	0.97375	82.2	180	0.97000						
66.1	151	0.97725	74.4	166	0.97350	82.8	181	0.96975						
66.7	152	0.97700	75.0	167	0.97325	83.3	182	0.96950						
67.2	153	0.97675	75.6	168	0.97300	83.9	183	0.96925						
67.8	154	0.97650	76.1	169	0.97275	84.4	184	0.96900						

°C = Observed Temperature in Degrees Celsius.
°F = Temperature in Degrees Fahrenheit.
*M = Multiplier for correcting volumes to the basis of 15.6 °C (60°F).

END ITEM P-603

Item P-605 Joint Sealants for Pavements

DESCRIPTION

605-1.1 This item shall consist of saw cutting joints, and providing and installing a resilient and adhesive joint sealing material capable of effectively sealing joints and cracks in pavements.

MATERIALS

605-2.1 Joint sealants. Joint sealant materials shall meet one or more of the requirements of the following types as indicated on the Contract Drawings:

ASTM D5893	Standard Specifications for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

Each lot or batch of sealant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, the safe heating temperature, and shall be accompanied by the manufacturer's certification stating that the sealant meets the requirements of this specification.

605-2.2 Backer rod. The material furnished shall be a compressible, non-shrinking, non-staining, non-absorbing material that is non-reactive with the joint sealant and shall meet the requirements of ASTM D 5249, Type 1 or Type 3. Type 1 backer rods shall be used for hot-applied sealants. Type 1 or Type 3 backer rods shall be used for cold-applied sealants.

The material shall have a water absorption of not more than 5% when tested in accordance with ASTM C509. The backer-rod material shall be 25% ± 5 % larger in diameter than the nominal width of the crack.

605-2.3 Backup materials. Provide backup material that is a compressible, nonshrinking, nonstaining, nonabsorbing material, nonreactive with the joint sealant. Backup material shall meet the requirements of ASTM D 5249, Type 2 sealant backer material. Type 2 backer material may be used for hot-applied sealants or cold-applied sealants.

Type 2 backer material is a sheet or strip material of various thicknesses either laminated or skived and is intended primarily for use where there is an opening the full depth of the pavement, such as an expansion joint for which it is desirable to have a filler material completely fill the opening and prevent or minimize the accumulation of water or incompressible materials below the sealant.

The material shall have a melting point at least 5°F (3°C) greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The material shall have a water absorption of not more than 5% of the sample weight when tested in accordance with ASTM C509. The backup material shall be 25 ±5% larger in diameter than the nominal width of the crack.

CONSTRUCTION METHODS

605-3.1 Time of application. Joints shall be sealed as soon after completion of the curing period as

feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be 50°F (10°C) and rising at the time of application of the poured joint sealing material. Do not apply sealant if moisture is observed in the joint.

When used with P-606, such as light can installation, P-605 shall not be applied until the P-606 has fully cured.

605-3.2 Equipment. Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and maintained in satisfactory condition at all times. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 30 days prior to use on the project.

a. Tractor-mounted routing tool. Provide a routing tool, used for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

b. Concrete saw. Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not provide a clean joint.

c. Sandblasting equipment. Sandblasting is not allowed.

d. Waterblasting equipment. Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. Provide water tank and auxiliary resupply equipment of sufficient capacity to permit continuous operations. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately one inch (25 mm) above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle as necessary to obtain satisfactory results. A pressure gauge mounted at the pump shall show at all times the pressure in psi (kPa) at which the equipment is operating.

e. Hand tools. Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

f. Hot-poured sealing equipment. The unit applicators used for heating and installing ASTM D6690 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

g. Cold-applied, single-component sealing equipment. The equipment for installing ASTM D5893 single component joint sealants shall consist of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. The dimension of the nozzle shall be such that the tip of the nozzle will extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier's instructions, and unaltered in any way without obtaining prior approval. Small hand-held air-powered equipment (i.e., caulking guns) may be used for small applications.

605-3.3 Preparation of joints.

a. Sawing. All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary.

b. Sealing. Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, filler, protrusions of hardened concrete, old sealant and other foreign material from the sides and upper edges of the joint space to be sealed. Cleaning shall be accomplished by tractor-mounted routing equipment, concrete saw or waterblaster as specified in paragraph 605-3.2. The newly exposed concrete joint faces and the pavement surface extending a minimum of 1/2 inch (12 mm) from the joint edge shall be sandblasted clean. Cleaning shall not damage the joint face or the pavement surface. If the Engineer determines that damage to the joint face or pavement surface occurs, then the Contractor shall revise their cleaning methods. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave them completely free of debris and water. The joint faces shall be surface dry when the seal is applied.

In areas where existing joint sealant is in poor condition, it shall be completely removed. Existing joint sealant in sound condition may remain in place, if so ordered by the Engineer, and the existing sealant is compatible with new sealant.

c. Backer rod and back-up material. When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a backer rod or back-up material to prevent the entrance of the sealant below the specified depth. Take care to ensure that the backer rod or backup material is placed at the specified depth and is not stretched or twisted during installation.

605-3.4 Installation of sealants. Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer before sealing is allowed. Sealants shall be installed in accordance with the following requirements:

Immediately preceding, but not more than 50 feet (15 m) ahead of the joint sealing operations, perform a final cleaning with compressed air. Fill the joints from the bottom up to to the depth below the pavement surface specified on the plans. Remove and discard excess or spilled sealant from the pavement by approved methods. Install the sealant in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's instructions. Check the joints frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

The use of a backer rod or backup material in the bottom of the joint to be filled is required to control the depth of the sealant, to achieve the desired shape factor, and to support the sealant against indentation and sag. Backer rod or backup materials should be compatible with the sealant, should be compressible without extruding the sealant, and should recover to maintain contact with the joint faces when the joint is open.

605-3.5 Inspection. The Contractor shall inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified at no additional cost to the airport.

605-3.6 Clean-up. Upon completion of the project, remove all unused materials from the site and leave the pavement in a clean condition.

METHOD OF MEASUREMENT

605-4.1 No separate measurement for payment shall be made for joint and crack sealing. Joint and crack sealing shall be considered necessary and incidental to the work of this Contract.

BASIS OF PAYMENT

605-5.1 No payment will be made separately or directly for joint and crack sealing. Joint and crack sealing shall be considered necessary and incidental to the work of this Contract and the costs shall be included in the various pay items involved.

SUBMITTALS AND CERTIFICATIONS.

605-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Catalog Data showing that the joint sealer meets the requirements specified.
- Catalog data showing that backer rod meets the requirements specified.
- Catalog data showing that back-up material meets the requirements specified.

TESTING REQUIREMENTS

ASTM C509 Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material

MATERIAL REQUIREMENTS

ASTM D789 Standard Test Method for Determination of Relative Viscosity of Polyamide (PA)

ASTM D6690 Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

END ITEM P-605

Item P-606 Adhesive Compounds, Two-Component for Sealing Wire and Lights in Pavement

DESCRIPTION

606-1.1. This specification covers two types of material; a liquid suitable for sealing electrical wire in saw cuts in pavement and for sealing light fixtures or bases in pavement, and a paste suitable for embedding light fixtures in the pavement. Both types of material are two-component filled formulas with the characteristics specified in paragraph 606-2.4. Materials supplied for use with bituminous concrete pavements must be formulated so they are compatible with the bituminous concrete.

EQUIPMENT AND MATERIALS

606-2.1 Curing. When 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.

606-2.5 Containers. Adhesive compounds shall be delivered to the project site in their original containers, unopened and with labels indicating the manufacturer, lot number and material certification.

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

Physical or Electrical Property	Minimum	Maximum	ASTM Method
Tensile			
Portland cement concrete	1,000 psi (70 kg/sq cm)		D 638
Bituminous concrete	500 psi (35 kg/sq cm)		
Elongation			
Portland cement concrete		See note [1]	D 638
Bituminous concrete	50%		D 638
Coef. of cub. exp. cu. cm/cu. cm/°C	0.00090	0.00120	D 1168
Coef. of lin. exp. cm/cm/°C	0.000030	0.000040	D 1168
Dielectric strength, short time test	350 volts/mil.		D 149
Arc resistance	125 sec		
Pull-off			
Adhesion to steel	1,000 psi (70 kg/sq cm)		
Adhesion to Portland cement concrete	200 psi (14 kg/sq cm)		
Adhesion to asphalt concrete	No test available.		
Adhesion to aluminum	250 psi		

[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

Type	Sieve Size	Percent Passing
Coarse Aggregate	3/4 inch (19 mm)	97 to 100
	1/2 inch (12 mm)	63 to 69
	3/8 inch (9 mm)	30 to 36
	No. 4 (4.75 mm)	0 to 3
Fine Aggregate	No. 4 (4.75 mm)	100
	No. 8 (2.36 mm)	82 to 88
	No. 16 (1.18 mm)	60 to 70
	No. 30 (600 µm)	40 to 50
	No. 50 (300 µm)	16 to 26
	No. 100 (150 µm)	5 to 9

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 and/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.

METHOD OF MEASUREMENT

606-4.1 No measurement will be made for direct payment of adhesive compounds as the cost of furnishing and installing shall be considered as a subsidiary obligation in the completion of the work.

BASIS OF PAYMENT

606-5.1 No payment will be made separately or directly for this item on any part of the work unless otherwise listed in the various pay items. All adhesive compounds will be considered a necessary and incidental part of the work and its cost shall be considered by the Contractor and included in the contract price for the pay items of work involved.

SUBMITTALS AND CERTIFICATIONS

606-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Certification that adhesive compounds meet the requirements specified or certified test results.

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 D638	Standard Test Method for Tensile Properties of Plastics
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-620 Pavement Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes and the removal of existing markings on the surface of pavements, 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 this paragraph. Paint colors shall be in accordance with Federal Standard No. 595 as follows:

Fed Std. No 595 Color	Number
White	37925
Yellow	33538 or 33655

Paint for permanent pavement markings shall be used with reflective media, unless otherwise shown or specified. Paint for permanent markings shall be of the type specified in the pay items.

Black paint used to outline pavement markings shall be waterborne or solvent based, and shall not contain reflective media.

a. Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952E, Type I, Type II, or Type III. 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. The acrylic resin used for Type III shall be 100% cross linking acrylic as evidenced by infrared peaks at wavelengths 1568, 1624, and 1672 cm-l with intensities equal to those produced by an acrylic resin known to be 100% cross linking.

b. Epoxy. Paint shall be a two component, minimum 99% solids type system conforming to the following:

(1) Pigments. Component A. Percent by weight.

(a) White:

Titanium Dioxide, ASTM D476, type II shall be 18% minimum (16.5% minimum at 100% purity).

(b) Yellow and Colors:

Titanium Dioxide, ASTM D476, type II shall be 14 to 17%.

Organic yellow, other colors, and tinting as required to meet color standard.

Epoxy resin shall be 75 to 79%.

(2) Epoxy content. Component A. The weight per epoxy equivalent, when tested in accordance with ASTM D1652 shall be the manufacturer's target ±50.

(3) Amine number. Component B. When tested in accordance with ASTM D2074 shall be the manufacturer's target ±50.

(4) Prohibited materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

(5) Daylight directional reflectance.

(a) White: The daylight directional reflectance of the white paint shall not be less than 75% (relative to magnesium oxide), when tested in accordance with ASTM E2302.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 55% (relative to magnesium oxide), when tested in accordance with ASTM E2302. The x and y values shall be consistent with the Federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

(6) Accelerated weathering.

(a) Sample preparation. Apply the paint at a wet film thickness of 0.013 inch (0.33 mm) to four 3 × 6 inch (8 × 15 cm) aluminum panels prepared as described in ASTM E2302. Air dry the sample 48 hours under standard conditions.

(b) Testing conditions. Test in accordance with ASTM G154 using both Ultra Violet (UV-B) Light and condensate exposure, 72 hours total, alternating four (4) hour UV exposure at 140°F (60°C), and four (4) hours condensate exposure at 104°F (40°C).

(c) Evaluation. Remove the samples and condition for 24 hours under standard conditions. Determine the directional reflectance and color match using the procedures in paragraph 620-2.2b(5) above. Evaluate for conformance with the color requirements.

(7) Volatile organic content. Determine the volatile organic content in accordance with 40 CFR Part 60 Appendix A, Method 24.

(8) Dry opacity. Use ASTM E2302. The wet film thickness shall be 0.015 inch (0.38 mm). The minimum opacity for white and colors shall be 0.92.

(9) Abrasion resistance. Subject the panels prepared in paragraph 620-2.2b(6) to the abrasion

test in accordance with ASTM D968, Method A, except that the inside diameter of the metal guide tube shall be from 0.747 to 0.750 inch (18.97 to 19.05 mm). Five liters (17.5 lb (7.94 kg)) of unused sand shall be used for each test panel. The test shall be run on two test panels Both baked and weathered paint films shall require not less than 150 liters (525 lbs (239 kg)) of sand for the removal of the paint films.

(10) Hardness, shore. Hardness shall be at least 80 when tested in accordance with ASTM D2240.

c. Methacrylate. Paint shall be a two component, minimum 99% solids-type system conforming to the following:

(1) Pigments. Component A. Percent by weight.

(a) White:

Titanium Dioxide, ASTM D476, type II shall be 6% minimum.

Methacrylate resin shall be 18% minimum.

(b) Yellow and Colors:

Titanium Dioxide, ASTM D476, type II shall be 6% minimum.

Organic yellow, other colors, and tinting as required to meet color standard.

Methacrylate resin shall be 18% minimum.

(2) Prohibited materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

(3) Daylight directional reflectance:

(a) White: The daylight directional reflectance of the white paint shall not be less than 80% (relative to magnesium oxide), when tested in accordance with ASTM E2302.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 55% (relative to magnesium oxide), when tested in accordance with ASTM E2302. The x and y values shall be consistent with the Federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

(4) Accelerated weathering.

(a) Sample preparation. Apply the paint at a wet film thickness of 0.013 inch (0.33 mm) to four 3 × 6 inch (8 × 15 cm) aluminum panels prepared as described in ASTM E2302. Air dry the sample 48 hours under standard conditions.

(b) Testing conditions. Test in accordance with ASTM G154 using both Ultra Violet (UV-B) Light and condensate exposure, 72 hours total, alternating four (4) hour UV exposure at 140°F (60°C),

and four (4) hours condensate exposure at 104°F (40°C).

(c) Evaluation. Remove the samples and condition for 24 hours under standard conditions. Determine the directional reflectance and color match using the procedures in paragraph 620-2.2c(3) above. Evaluate for conformance with the color requirements.

(5) Volatile organic content. Determine the volatile organic content in accordance with 40 CFR Part 60 Appendix A, Method 24.

(6) Dry opacity. Use ASTM E2302. The wet film thickness shall be 0.015 inch (0.38 mm). The minimum opacity for white and colors shall be 0.92.

(7) Abrasion resistance. Subject the panels prepared in paragraph 620-2.2c(4) to the abrasion test in accordance with ASTM D968, Method A, except that the inside diameter of the metal guide tube shall be from 0.747 to 0.750 inch (18.97 to 19.05 mm). Five liters (17.5 lb (7.94 kg)) of unused sand shall be used for each test panel. The test shall be run on two test panels. Both baked and weathered paint films shall require not less than 150 liters (525 lbs (239 kg) of sand for the removal of the paint films.

(8) Hardness, shore. Hardness shall be at least 80 when tested in accordance with ASTM D2240.

d. Solvent-Base. Paint shall meet the requirements of Commercial Item Description A-A-2886B Type I, Type II, or Type III.

e. Preformed Thermoplastic Airport Pavement Markings. Markings must be composed of ester modified resins in conjunction with aggregates, pigments, and binders that have been factory produced as a finished product. The material must be impervious to degradation by aviation fuels, motor fuels, and lubricants.

(1) The markings must be able to be applied in temperatures as low as 35°F without any special storage, preheating, or treatment of the material before application.

(a) The markings must be supplied with an integral, non-reflectorized black border.

(2) Graded glass beads.

(a) The material must contain a minimum of 30% intermixed graded glass beads by weight. The intermixed beads shall conform to Federal Specification TT-B-1325D, Type I, gradation A or Federal Specification TT-B-1325D, Type IV.

(b) The material must have factory applied coated surface beads in addition to the intermixed beads at a rate of one (1) lb (0.45 kg) (±10%) per 10 square feet (1 sq m). These factory applied coated surface beads shall have a minimum of 90% true spheres, minimum refractive index of 1.50, and meet the following gradation.

Size Gradation		Retained, %	Passing, %
U.S. Mesh	µm		
12	1700	0 - 2	98 - 100
14	1400	0 - 3.5	96.5 - 100
16	1180	2 - 25	75 - 98
18	1000	28 - 63	37 - 72
20	850	63 - 72	28 - 37
30	600	67 - 77	23 - 33

Size Gradation		Retained, %	Passing, %
U.S. Mesh	μm		
50	300	89 - 95	5 - 11
80	200	97 - 100	0 - 3

(3) Heating indicators. The material manufacturer shall provide a method to indicate that the material has achieved satisfactory adhesion and proper bead embedment during application and that the installation procedures have been followed.

(4) Pigments. Percent by weight.

(a) White:

Titanium Dioxide, ASTM D476, type II shall be 10% minimum.

(b) Yellow and Colors:

Titanium Dioxide, ASTM D476, type II shall be 1% minimum.

Organic yellow, other colors, and tinting as required to meet color standard.

(5) Prohibited materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

(6) Daylight directional reflectance.

(a) White: The daylight directional reflectance of the white paint shall not be less than 75% (relative to magnesium oxide), when tested in accordance with ASTM E2302.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 45% (relative to magnesium oxide), when tested in accordance with ASTM E2302. The x and y values shall be consistent with the Federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

(7) Skid resistance. The surface, with properly applied and embedded surface beads, must provide a minimum resistance value of 45 BPN when tested according to ASTM E303.

(8) Thickness. The material must be supplied at a nominal thickness of 65 mil (1.7 mm).

(9) Environmental resistance. The material must be resistant to deterioration due to exposure to sunlight, water, salt, or adverse weather conditions and impervious to aviation fuels, gasoline, and oil.

(10) Retroreflectivity. The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of nighttime retroreflection when tested in accordance to ASTM E1710.

(11) Packaging. Packaging shall protect the material from environmental conditions until installation.

(12) Preformed thermoplastic airport pavement marking requirements.

(a) The markings must be a resilient thermoplastic product with uniformly distributed glass beads throughout the entire cross-sectional area. The markings must be resistant to the detrimental effects of aviation fuels, motor fuels and lubricants, hydraulic fluids, deicers, anti-icers, protective coatings, etc. Lines, legends, and symbols must be capable of being affixed to asphalt and/or Portland cement concrete pavements by the use of a large radiant heater. Colors shall be available as required.

(b) The markings must be capable of conforming to pavement contours, breaks, and faults through the action of airport traffic at normal pavement temperatures. The markings must be capable of fully conforming to grooved pavements, including pavement grooving per advisory circular (AC) 150/5320-12, current version. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastics when heated with a heat source per manufacturer's recommendation.

(c) Multicolored markings must consist of interconnected individual pieces of preformed thermoplastic pavement marking material, which through a variety of colors and patterns, make up the desired design. The individual pieces in each large marking segment (typically more than 20 feet (6 m) long) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a marking segment. Obtaining multicolored effect by overlaying materials of different colors is not acceptable due to resulting inconsistent marking thickness and inconsistent application temperature in the marking/substrate interface.

(d) The marking material must set up rapidly, permitting the access route to be re-opened to traffic after application.

(e) The marking material shall have an integral color throughout the thickness of the marking material.

620-2.3 Reflective media. Glass beads shall meet the requirements for Federal Specification TT-B-1325, Type I, gradation A, Type III or Type IV. 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.

Paint Color	Glass Beads, Type I, Gradation A	Glass Beads, Type III	Glass Beads, Type IV
White	See Table 1	See Table 1	See Table 1
Yellow	See Table 1	See Table 1	See Table 1
Red	See Table 1 and Note	Not used	See Table 1 and Note
Pink	See Table 1 and Note	Not used	See Table 1 and Note
Black	Not used	Not used	Not used
Green	Not used	Not used	Not used

620-2.4 Pavement sealer. Pavement sealer shall be a high quality asphalt pavement sealer with a filled sealer formula. Sealer shall have at least a 5 year warranty.

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. Painting operations shall not be performed when the weather is windy or foggy. The suitability of the weather will be determined by the Engineer. 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 sweeping and blowing or by other methods as required 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.

Paint shall not be applied to Portland cement concrete pavement until the areas to be painted are clean of curing material. Sandblasting or high-pressure water shall be used to remove curing materials.

At least 24 hours prior to remarking existing markings, the existing markings must be removed such that 75% of the existing markings are removed with a low pressure (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.

620-3.5 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 m^2).

620-3.6 Application. Unless otherwise shown on the plans, Contractor shall apply reflective media to all permanent runway and taxiway markings, with the exception of black paint. The costs for providing the materials shall be considered incidental to the work and shall be included in the pay items involved.

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:

Dimension and Spacing	Tolerance
36 inch (910 mm) or less	±1/2 inch (12 mm)
greater than 36 inch to 6 feet (910 mm to 1.85 m)	±1 inch (25 mm)
greater than 6 feet to 60 feet (1.85 m to 18.3 m)	±2 inch (50 mm)
greater than 60 feet (18.3 m)	±3 inch (76 mm)

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 time in accordance with the manufacturer's recommendation shall elapse between placement of a bituminous surface course or seal coat and application of the paint.

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 manufactures application and surface preparation requirements must be submitted to the Engineer prior to the initial application of markings.

Table 1. Application Rates For Paint And Glass Beads
(See Note regarding Red and Pink Paint)

Paint Type	Paint Square feet per gallon, ft^2/gal (Sq m per liter, m^2/l)	Glass Beads, Type I, Gradation A Pounds per gallon of paint-lb/gal (Kg per liter of paint-kg/l)	Glass Beads, Type III Pounds per gallon of paint-lb/gal (Kg per liter of paint-kg/l)	Glass Beads, Type IV Pounds per gallon of paint-lb/gal (Kg per liter of paint-kg/l)
Waterborne Type I or II	115 ft^2/gal max (2.8 m^2/l)	7 lb/gal min (0.85 kg/l)	10 lb/gal min (1.2 kg/l)	--
Waterborne Type III	90 ft^2/gal max (2.2 m^2/l)	--	10 lb/gal min (1.2 kg/l)	
Waterborne Type III	55 ft^2/gal max (1.4 m^2/l)			8 lb/gal min (1.0 kg/l)
Solvent Base	115 ft^2/gal max (2.8 m^2/l)	7 lb/gal min (0.85 kg/l)	10 lb/gal min (1. 2 kg/l)	--
Solvent Base	55 ft^2/gal max (2.2 m^2/l)	--	--	8 lb/gal min (1.0 kg/l)
Epoxy	90 ft^2/gal max (2.2 m^2/l)	15 lb/gal min (1.8 kg/l)	20 lb/gal min (2.4 kg/l)	16 lb/gal min (1.9 kg/l)
Methacrylate	45 ft^2/gal max (1.1 m^2/l)	15 lb/gal min (1.8 kg/l)	20 lb/gal min (2.4 kg/l)	16 lb/gal min (1.8 kg/l)

Note: The glass bead application rate for Red and Pink paint shall be reduced by 2 lb/gal (0.24 kg/l) for Type I and Type IV beads. Type III beads shall not be applied to Red or Pink paint.

Paint used for temporary markings shall be waterborne or solvent base and shall not contain reflective media, unless otherwise shown or specified. The application rate for temporary markings shall be between 230 square feet (minimum) per gallon, to 380 square feet (maximum) per gallon.

Unless otherwise shown, glass beads shall be distributed upon the marked areas 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.

620-3.9 Removal of existing markings. Existing markings which are shown to be removed shall be blocked out into rectangular shapes. Markings within the rectangular shapes shall be removed by waterblasting, shotblasting, grinding, or sandblasting, such that 90% of all paint is removed to the satisfaction of the Owner and Engineer. Shotblasting shall not be used on grooved pavements. The remaining pavement area within the rectangular shape shall be treated with the same removal process such that the entire rectangular shape is uniform in appearance. Existing markings that do not conform to proposed markings shall be removed by sandblasting or vacuum blasting, such that 90% of all paint is removed to the satisfaction of the Owner and Engineer. On bituminous pavements, the Contractor shall apply a pavement sealer to the entire blocked out area of treatment for paint removal. Pavement sealer shall be applied in accordance with the manufacturer's recommendations. Black paint shall not be used to cover markings. No direct payment for the work of this section will be made. All marking removal shall be considered a necessary and incidental part of the work and the costs shall be included in the various pay items involved.

620-3.10 Removal of temporary markings. Temporary markings shall be removed in accordance with Section 3.9, Removal of Existing Markings, of this specification. No direct payment will be made for this item. The costs of removal of temporary markings shall be included in Item M-100, Maintenance and Protection of Traffic.

METHOD OF MEASUREMENT

620-4.1 The quantity of runway and taxiway markings to be paid for shall be the number of square feet of painting (including reflective media) performed in accordance with the specifications and accepted by the

Engineer.

BASIS OF PAYMENT

620-5.1 Payment shall be made at the respective contract price per square foot for runway and taxiway painting (including reflective media)**.** This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

Item P-620-5.1	Pavement Marking - per square foot

SUBMITTALS AND CERTIFICATIONS

620-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Manufacturer's certified test reports showing that paint meets the requirements specified.
- Manufacturer's certified test reports showing that reflective media meets the requirements specified.
- Catalog data or manufactures data for pavement sealer.

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
ASTM D711	Standard Test Method for No-Pick-Up Time of Traffic Paint
ASTM D968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
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 E1710	Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
ASTM E2302	Standard Test Method for Measurement of the Luminance Coefficient Under Diffuse Illumination of Pavement Marking Materials Using a Portable Reflectometer

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

29 CFR Part 1910.1200 Hazard Communication

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 D-701 Pipe for Storm Drains and Culverts

DESCRIPTION

701-1.1 This item shall consist of the construction or removal of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

The bid price per linear foot of pipe in place shall include the cost of excavation, backfill and restoration of surfaces, removal of water, the cost of furnishing and installing all trench bracing, all pipe and fittings required to complete the pipe drain as shown on the Contract Drawings and the material for and the making of all joints including all connections to existing drainage pipe and structures

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below.

701-2.2 Pipe. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

701-2.3 Concrete. Concrete for pipe cradles and uses other than to construct the pipe shall conform to the following requirements:

Concrete shall conform to the requirements of Caltrans Section 90, Portland Cement Concrete with the exception that the minimum compressive strength shall be 4000 psi at 28 days.

701-2.4 Rubber gaskets. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443. Rubber gaskets for PVC pipe, polyethylene, and polypropylene pipe shall conform to the requirements of ASTM F477. Rubber gaskets for zinc-coated steel pipe and precoated galvanized pipe shall conform to the requirements of ASTM D1056, for the “RE” closed cell grades. Rubber gaskets for steel reinforced thermoplastic ribbed pipe shall conform to the requirements of ASTM F477.

Gaskets for ribbed PVC pipe shall be flexible elastomeric seals conforming to ASTM D 3212.

701-2.5 Joint mortar. Pipe joint mortar shall consist of one part Portland cement and two parts sand, by volume. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of 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 C-206. The water shall be clean and free of deleterious amounts of acid, alkalies,

or organic material. If the water is of questionable quality, it shall be tested in accordance with AASHTO T-26.

701-2.6 Joint fillers. Poured filler for joints shall conform to the requirements of ASTM D6690.

701-2.7 Plastic gaskets. Plastic gaskets shall conform to the requirements of AASHTO M198 (Type B).

701-2.8. Controlled low-strength material (CLSM). Controlled low-strength material shall conform to the requirements of Caltrans Section 19-3.02F with the exception that strength shall achieve a minimum 100 psi.

701-2.9 Brick. Brick, if required, shall conform to the requirements of ASTM C 32, Grade SM.

CONSTRUCTION METHODS

701-3.1 Excavation. The Contractor shall do all unclassified excavation to the required depths as shown on the Contract Drawings. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe.

The Contractor shall comply with all current Federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactorily jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail. The trench bottom shall be shaped to fully and uniformly support the bottom quadrant of the pipe.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch (200 mm). The excavation below grade shall be backfilled with Caltrans Section 26.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with Caltrans Section 26 aggregate for the full trench width. The Engineer shall determine the depth of removal necessary.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

All required excavation shall be included in the unit price bid per lineal foot for the pipe, including rock excavation, if encountered.

The Contractor shall do such trench bracing, sheeting or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheeting or shoring shall not be removed in one operation, but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheeting or shoring and the removal of same shall be considered as a subsidiary obligation of the Contractor and included in the contract price for the pay items of work involved.

701-3.2 Pipe bed. Pipe bed shall be placed in accordance with Caltrans Section 26. The pipe bed shall be placed to the depths and widths as shown on the Contract Drawings or as directed by the Engineer. The

pipe bed shall be true to grade and provide uniform support along the entire length of pipe. Soil below the pipe shall be compacted to 95% maximum density for non-cohesive soils and 90% maximum density for cohesive soils in accordance with ASTM D 698.

701-3.3 Laying pipe. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

The Contractor's facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged or disturbed. The Engineer shall inspect all pipe before it is laid and reject any section that is damaged by handling or is defective to a degree which will materially affect the function and service of the pipe.

The grade and alignment of each pipe shall be determined and maintained by the use of an approved laser system or approved batter boards (over the trench or parallel lines).

The laser system shall be operated according to the manufacturer's recommendations and safety standards. The line and grade of the laser shall be checked at not more than 50-feet away from the starting point and then periodically throughout the course of the working day. Any variation from the line and grade shall be immediately reported to the Engineer.

When the line parallel to the grade of the sewer is used, this line is to be supported above the ground surface on batter boards spaced not to exceed 40-feet apart and rigidly anchored to and supported by substantial posts driven into the ground on each side of the trench. Not less than 3 batter boards shall be installed and maintained in proper position at all times as a check on the accuracy of the grade lines. The Engineer shall be immediately notified of any misalignment of batter boards set in accordance with established cuts or elevations. The elevations of batter boards and the alignment of the grade line shall be determined from the elevations and alignment of the offset points located alongside the trench except where established directly by means of surveying instruments.

The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform. The pipe shall be protected from water during placement and until the mortar in the joints has thoroughly set. Contractor shall scoop out areas to accommodate bell ends of pipe. Pipe shall not be laid on frozen ground.

The upgrade end of pipelines not terminating in a structure shall be plugged or capped as approved by the Engineer. Pipe which is not true in alignment or which shows any settlement after laying shall be taken up and relaid without extra compensation.

The Contractor shall provide, as may be necessary, for the temporary diversion of stream flow in order to permit the installation of the pipe under dry conditions

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer’s reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

701-3.4 Joining pipe. Pipe joints shall be made with rubber gaskets, elastomeric seals, plastic gaskets or coupling bands. Gaskets and elastomeric seals shall be installed to form a flexible watertight seal.

a. Concrete pipe. Concrete pipe may be either bell and spigot or tongue and groove. The method of joining pipe sections shall be so the ends are fully entered and the inner surfaces are reasonably flush and even.

b. Metal pipe. Metal pipe shall be firmly joined by form-fitting bands conforming to the requirements of ASTM A760 for steel pipe and AASHTO M196 for aluminum pipe.

c. PVC, polyethylene and polypropylene pipe. Joints for PVC, Polyethylene, and Polypropylene pipe shall conform to the requirements of ASTM D3212 when water tight joints are required. Pipe joints shall be made with bell and spigot ends. Gaskets shall be installed at the factory such that the joints will be water-tight. Contractor shall apply a lubricant, supplied by the manufacturer, to the gasket and the bell end of the pipe before joining two sections of pipe. Unless otherwise approved by the Engineer, Contractor shall not use pipe bands to join the pipe. Gaskets for polyethylene pipe shall conform to the testing requirements of ASTM F477. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M252 or ASTM M294. Fittings for polypropylene pipe shall conform to ASTM F2881, ASTM F2736, or ASTM F2764.

701-3.5 Backfilling. Pipes shall be inspected before any backfill is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense.

Material for backfill shall be as specified, or as shown on the Contract Drawings. Backfill with suitable on-site material, when specified, shall not contain stones that would be retained on a 2-inch sieve, frozen lumps, chunks of highly plastic clay or other objectionable material. If specified, flowable backfill shall meet the requirements of Caltrans Section 19 for Controlled Low Strength Material.

a. Concrete and Metal Pipe: Pipe haunches shall be backfilled with Caltrans Section 26and shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on both sides of the pipe. Compaction shall be performed using hand tampers. Contractor shall ensure that Lining is placed under the pipe haunches during placement of these lifts to eliminate any voids. Lining shall be compacted to 100% of maximum density.

Backfill shall be compacted in layers not exceeding 6 inches on both sides of the pipe and to the depths shown on the Contract Drawings. Material shall be brought up evenly on both sides of the pipe.

Backfill shall be compacted in layers not exceeding 6 inches across the entire width of the pipe trench. Lining shall be compacted with mechanical compaction equipment to 100% of maximum density.

Backfill for pipe trenches under pavements shall be Caltrans Section 26 to the bottom of the pavement section.

Backfill for pipe trenches in turf areas shall be suitable on-site material. Backfill with suitable on-site material shall be compacted to the density required in Item P-152, Excavation and Embankment.

b. Polyethylene and PVC Pipe: Pipe haunches shall be backfilled with Caltrans Section 26. Lining shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on both sides of the pipe to the spring line. Compaction shall be performed using hand tampers. Contractor shall ensure that Lining is placed under the pipe haunches during placement of these lifts to

eliminate any voids. Contractor shall take precautions during placement of material under the pipe haunches to prevent movement or displacement of the pipe. Lining shall be compacted to 90% of maximum density.

Initial backfill above the spring line shall be with Caltrans Section 26. backfill shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on both sides of the pipe to a minimum depth of one foot above the top of the pipe. Lining shall be compacted with mechanical compaction equipment. Lining directly over the pipe shall not be compacted with mechanical compaction equipment until backfill has reached a height of 12 inches above the pipe. Contractor shall not operate compaction equipment such that it comes in direct contact with the pipe. Lining for initial backfill shall be compacted to 95% of maximum density. Contractor shall take necessary precautions to ensure that the backfill is properly compacted without deforming or damaging the pipe.

Final backfill for pipes under pavements shall be with Caltrans Section 26. Lining shall be compacted in layers not exceeding 6 inches across the entire width of the pipe trench up to the pavement subgrade. Lining shall be compacted with mechanical compaction equipment to 100% of maximum density.

Final backfill for pipe in turfed areas shall be suitable on-site material. Backfill with suitable on-site material shall be compacted to the density required in Item P-152, Excavation and Embankment.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

701-3.6 Pipe removal. Where existing pipes are to be removed in the same trench as proposed pipes, the Contractor shall consider such removal including headwalls and end sections as an incidental part of construction and include the costs thereof in the various pay items involved. Where existing pipes are to be removed outside of proposed trenching limits, they shall be paid for separately. The cost of such removal shall include excavation, pipe removal, headwall and end section removal, disposal, bulkheads, and backfill. Restoration shall be as specified below in the section titled "Cleaning and Restoration of Site". Backfill shall be with suitable on-site material unless otherwise shown or specified. Backfill under paved areas shall be as shown on the plans. Pipes to be removed shall be as shown on the plans and as directed by the Engineer. When pipes are removed and disconnected from existing structures, the opening in the structure shall be closed watertight with brick and mortar. When pipes are to be replaced, any structure modifications required to accept the proposed pipe shall be done with all connections grouted watertight.

701-3.7 Connections. Where the Contract Drawings call for connections to existing or proposed structures, these connections shall be watertight and made so that a smooth uniform flow line will be obtained throughout the drainage system.

701-3.8 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. Suitable material may be deposited in embankment or shoulders areas. Unsuitable material shall be disposed of off airport property or as ordered by the Engineer.

Areas disturbed by the Contractor's operation shall be restored to their original condition. Restoration of surfaces shall be performed in accordance with the details shown on the plans.

Where pipes are installed or removed outside of the general grading limits, or in areas that would not otherwise be disturbed, restoration shall be considered necessary and incidental to the work of this item and the costs shall be included in the associated pay items for pipe installation or pipe removal.

Where pipes are installed or removed within the general grading limits, restoration of the area will not be necessary as payment for establishment of turf or pavement will be included in the various pay items of work involved.

The Contractor shall be responsible for maintaining all disturbed surfaces and restorations until final acceptance.

701-3.9 Inspection. Prior to final approval of the drainage system, the Engineer, accompanied by the Contractor's representative, shall make a thorough inspection by an appropriate method of the entire installation. Any indication of defects in material or workmanship or obstruction to flow in the pipe system shall be further investigated and corrected. Defects due to the Contractor's negligence shall be corrected by the Contractor without additional compensation and as directed by the Engineer.

To detect leakage in precast concrete pipes installed under existing or proposed pavement, the pipe shall be subjected to an exfiltration test in accordance with ASTM C 969, or precast concrete pipe between 4 inches and 24 inches in diameter may be tested with low pressure air in accordance ASTM C 924. The exfiltration test shall be performed between consecutive manholes (or end sections). The test shall be performed by filling the pipe with water to a height of two feet above the top of the pipe at the upstream manhole or two feet above ground water, whichever is higher, and allowing the pipe to remain saturated for a period of 72 hours. When subjected to such test, the allowable leakage shall not exceed 200 gallons per inch of pipe diameter per mile in a 24-hour period. Allowable losses for air pressure testing shall meet the criteria contained in ASTM C 924. Use or failure of an air test shall not preclude acceptance by appropriate water exfiltration testing.

To detect leakage in plastic pipes installed under existing or proposed pavement, the pipe shall be subjected to a low pressure air in accordance ASTM F 1417. Allowable losses for air pressure testing shall meet the criteria contained in ASTM F 1417.

Any pipe sections failing the exfiltration or air test shall be repaired and retested. If passing tests cannot be achieved, the pipe sections shall be removed and new pipe installed.

701-3.10 Removal of water. The Contractor is responsible for removal of water regardless of its source. Measures shall be taken to protect the excavation from surface water runoff as well as for dewatering the excavation from any water which has entered the excavation. The cost of the removal of water shall be considered as a subsidiary obligation of the Contractor and included in the contract price for the pay items of work involved.

METHOD OF MEASUREMENT

701-4.1 The length of pipe shall be measured in linear feet of pipe in place, completed, and approved. It shall be measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. The length of end section shall be included in the length of pipe from invert to invert. The several classes, types and size shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipe being measured. All trenching, excavation, pipe removals in the same trench, backfill with on-site material, sheeting and bracing, restoration of

surfaces, dewatering, structure modifications, connections, fittings and pressure tests shall be included in the footage as typical pipe sections in the pipe being measured.

701-4.2 The number of each type and size of end section shall be included in the price of linear foot of pipe and shall considered incidental to the entire total length of pipe.

BASIS OF PAYMENT

701-5.1 Payment will be made at the contract unit price per linear foot for each kind of pipe of the class, type and size designated to be installed.

These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item D-701-6.1 18 Inch Diameter, Ga. Corrugated Metal Pipe - per linear foot

SUBMITTALS AND CERTIFICATIONS

701-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Catalog data for each type of pipe meeting the requirements specified.

MATERIAL REQUIREMENTS

AASHTO M167	Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M190	Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M198	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
AASHTO M219	Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M243	Standard Specification for Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter

AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter
ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A761	Standard Specification for Corrugated Steel Structural Plate, Zinc Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A849	Standard Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM B745	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
ASTM C14	Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready Mixed Concrete
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C506	Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C507	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe
ASTM C655	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
ASTM C1433	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
ASTM D1056	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F667	Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR PR) Based on Outside Diameter
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
ASTM F2435	Standard Specification for Steel Reinforced Polyethylene (PE) Corrugated Pipe
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
ASTM F2736	Standard Specification for 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F2764	Standard Specification for 30 to 60 in. (750 to 1500 mm) Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
ASTM F2881	Standard Specification for 12 to 60 in. (300 to 1500 mm) Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

END ITEM D-701

ITEM D-707 WATER MAIN (DUCTILE IRON PIPE)

707-1 DESCRIPTION.

707-1.1 This item shall consist of ductile iron pipe, gate valves and hydrants of the class and size as shown on the Contract Drawings and installed in accordance with the details as shown on the Contract Drawings and as directed by the Engineer. This item shall also include all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, testing, dewatering and restoration of surfaces to the satisfaction of the Engineer. Unless otherwise provided for elsewhere, this item shall also include the removal, disposal, cutting, capping and sealing of waterline encountered on this project.

Prior to ordering any fittings which will be used on the existing water mains, the Contractor shall excavate the existing water main to determine the outside diameter of the pipe in order to determine the proper size couplings to be used.

The waterline shall be installed in accordance with these Specifications and with the lines and grades given.

707-2 MATERIALS.

707-2.1 DUCTILE IRON PIPE. All ductile iron pipe shall meet the latest ANSI Specification A21.51 thickness for Class 52. The ductile iron pipe shall be full lengths of 18 feet or longer with beveled and marked ends. The class or nominal thickness, manufacturer's mark, year pipe produced and the letters D1 or Ductile shall be cast or stamped on pipe. Cast marks to be near bell portion of pipe. The pipe shall have cement mortar lining in accordance with American Standard Association Specification ASA A21.4 (AWWA-C10464). The pipe shall have a coating of coal tar pitch varnish on the outside and an inside protection coating of a tasteless and odorless bituminous paint. The joint shall be a push on type joint with a single groove for rubber gasket known as Tyton Joint or equal. Rubber gasket shall be installed by manufacturer in each bell of pipe. There shall be two bronze wedges supplied for each joint of pipe, gasket and lubricant. The cost for the bronze wedges, gaskets and lubricant shall be included in the cost of the pipe. All bell and spigot ends of pipe to be tested with circular gauges which may be known as a go-no go gauge. Contractor shall provide information from the manufacturer on how the pipe was manufactured and certification that it is genuine ductile iron pipe.

707-2.2 RESILIENT SEATED GATE VALVES. Resilient seated gate valves for underground use shall be furnished in accordance with the requirements of the latest "Specifications for Resilient Seated Gate Valves for Ordinary Water Works Service" adopted by the American Water Works Association, C509 but shall meet the specific requirements and exceptions to the aforementioned specifications, which follow:

A. Resilient seated gate valves shall have mechanical joint ends with accessories including lead tipped gasket unless otherwise specifically required or permitted.

B. Resilient seated gate valves shall open by turning counterclockwise. The body shall be ductile or cast iron. The shaft shall be made of bronze with "O" ring seals and shall be lubricated and ready for use.

C. Operating nuts shall be 2 inches square and shall be loosely fitted on the stems.

D. All resilient seated gate valves shall be tested under a hydrostatic pressure of 200 pounds per square inch and show no leak.

E. All iron work, after being thoroughly cleaned, shall be coated with asphaltum varnish.

707-2.3 CAST IRON FITTINGS. Fittings shall conform to the latest ANSI A21-10-1977 (AWWA C110-77) and supplements A21.10a (C11a-72.) Mechanical joints shall conform to the latest ANSI Specifications A21.11-1979 (AWWA C111-79) with cast iron glands, bolts, nubs and plain rubber gaskets. Cast iron fittings 2 inches through 12 inches to be Class 250; 14 inches and up shall be Class 150. Fittings shall be tar coated inside and outside. Swivel tees shall be provided at hydrant tee locations.

707-2.4 FIRE HYDRANTS. All fire hydrants shall conform to AWWA Specification C-502.

All hydrants shall have a 4 inch pumper outlet and two 2-1/2 inch hose outlets unless otherwise specified.

Hydrant valve openings shall not be less than 4 inches and capable of delivering 500 gallons per minute through two 2-1/2 inch hose outlets with a loss of not more than 2 psi in the hydrant.

Hydrants shall have breakaway features of such design that when the barrel is broken off the hydrant will remain closed.

Hose and pumper outlets shall be of the exact type, size and threads as required by the Fire Department serving the area in which the hydrant is to be located.

Hydrants shall open counterclockwise and the direction of opening shall be indicated by means of an arrow and appropriate wording cast in the top of the hydrant.

Hydrants shall be connected to the 6 inch hydrant branch by the method shown on the Contract Drawings. The barrel length shall be such that the hydrant can be installed as specified herein.

Drains, drain valves and "O" rings seals shall be provided on all hydrants.

All hydrants shall be painted red and the top dome shall be painted fluorescent red.

Hydrants shall be set plumb with the pumper outlet facing the roadway. The hydrant shall be installed with the inlet piping buried to a minimum depth of cover of 5 feet. The distance from the centerline of the pumper nozzle to the finished grade shall be a minimum of 18 inches and a maximum of 24 inches and the distance from the center of the hydrant to the center of the hydrant branch gate valve box shall be a minimum of 30 inches.

707-2.5 CONCRETE. Concrete shall conform to the requirements of Caltrans Section 90 Concrete with the exception that the minimum compressive strength shall be 4,000 psi at 28 days.

707-2.6 REINFORCING STEEL. All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM designation A-615 Grade 60.

707-2.7 LINING. Lining shall conform to the requirements of Caltrans Section 26 Aggregate.

707-2.10 REDUCER. All water line reducers shall be ductile iron, centric, and conform to the requirements listed in Section 707-2.3 for fittings.

707-3 SUBMITTALS AND CERTIFICATIONS.

707-3.1 Submittals of "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and

"Certifications" for review shall be submitted in accordance with appropriate sections of the General Provisions. Submittals and Certifications required are as follows:

- Catalogue data and certification showing that ductile iron pipe meets the requirements specified
- Information from pipe manufacturer on how the pipe was manufactured.
- Catalogue data and certification showing that resilient seated gate values meet the requirements specified
- Catalogue data and certification showing that cast iron fittings meet the requirements specified
- Catalogue data and certification showing that fire hydrants meet the requirements specified.
- Concrete mix design

707-4 CONSTRUCTION METHODS.

707-4.1 GENERAL. Installation of water mains valves and hydrants will be made in accordance with the procedures and details set forth in the Contract Documents.

The Resident Engineer must be present at the time the new waterline is connected to the existing waterline and during the chlorination process. The Contractor shall notify the Engineer in advance of such operations to allow time for scheduling with the proper County Representatives to be on-site.

Where existing waterline is to be abandoned in place, it shall be cut, capped and sealed in accordance with the details of the Contract Plans. The Contractor shall consider such removal, cutting, capping and sealing an incidental part of construction.

707-4.2 EXCAVATION. The Contractor shall do all necessary excavation to the depth shown on the Contract Drawings. The excavation shall be unclassified and shall be performed regardless of the material encountered. All excavation shall be in accordance with Item P-152, Excavation and Embankment.

707-4.3 HANDLING AND INSTALLATION. All ductile iron pipe and fittings shall be handled with padded slings or other appropriate equipment. Cables or chains will not be permitted around the pipe for handling. All pipe shall be placed on suitable storage racks or padding and shall not be rolled on the ground.

Except as otherwise specified, all ductile iron pipe shall be installed in accordance with AWWA Specification C600. Great care shall be taken during loading, transportation and unloading to prevent injury to the pipe or coatings. Under no circumstances shall pipe be dropped. All pipe and fittings shall be carefully examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Engineer.

If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor at his own expense. All pipe and fittings shall be thoroughly cleaned before laying and shall be kept clean until they are used in the completed work and when laid, shall conform to the lines and grades shown.

Pipe shall be installed with bell ends in the direction of laying. No pipe shall be laid upon a foundation in which frost exists.

Blocking of pipelines laid in the ground will not be permitted unless pipe is to be laid with concrete cradle or encasement. Open ends of pipe shall be kept plugged with a bulkhead during construction. Sufficient backfill shall be placed or other precautions shall be taken to prevent flotation or movement.

707-4.4 ANCHORS AND TIE RODS. Concrete backing and/or tie rods and concrete anchors shall be

provided at all tees, bends and in other locations where shown on the Contract Drawings or as directed by the Engineer. Tie rods for interior service shall be of mild steel except where high tensile strength steel is called for on the Contract Drawings. High tensile steel rods where required shall have a minimum yield strength of 70,000 psi.

Tie rods installed in the ground or in contact with water shall be of ANSI Type 501 and 502, shall be stainless steel or an approved higher alloy.

707-4.5 SHEETING AND BRACING. The Contractor shall do such trench bracing, sheeting or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheeting or shoring shall not be removed in one operation, but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheeting or shoring and the removal of same shall be included in the unit price bid per foot for the pipe. All trench bracing, sheeting and shoring shall be in accordance with the Sheeting and Bracing section of the General Provisions.

707-4.6 BACKFILLING. The entire portion of the pipe trench shall be refilled with suitable materials placed in horizontal layers not more than 8 inches in thickness, each layer to be thoroughly compacted to prevent future settlement. Backfill for pavements shall be per Caltrans Section 26 Aggregate.

707-4.7 PRESSURE LEAKAGE TEST. All dirt and foreign matter shall be removed by a thorough flushing of the newly laid pipeline. The leakage test may be applied to the whole line or to valved sections. The pipe shall be subjected to hydrostatic pressures of a minimum of 150 pounds per square inch, based on the elevation of the lowest point of the line or section under test, and 1.25 times the working pressure at the highest point along the test section for a period of at least 120 minutes, or longer as may be directed by the Engineer. Any leaks shall be stopped in a manner satisfactory to the Engineer and Owner. The permissible leakage for the section under test shall not exceed the maximum allowable as specified in the latest AWWA Standard Specifications for gray and ductile cast iron water mains, Designation C-600.

707-4.8 CHLORINATION. Disinfection shall be in accordance with procedure set forth in AWWA Standard C-601 current edition. Prior to chlorination, all dirt and foreign matter shall be removed by a thorough flushing of the newly laid pipeline. The initial filling of the pipeline shall be with a disinfecting solution of not less than 100 ppm of chlorine. This solution shall remain in the line for 24 hours. The chlorine residual shall not be less than 25 ppm at any point in the pipe at the end of the 24 hour retention period. Flushing the disinfection solution of the newly laid line can begin 24 hours after the line is filled, but under no circumstances shall the disinfection solution remain in the line more than 48 hours. After the line has been thoroughly flushed, it is the responsibility of the Contractor to take the required bacteria samples to the local Health Department Laboratory for testing or to a laboratory certified by the State Department of Health. If the bacteria samples taken are acceptable, the water line may be put into service as the Engineer and Owner direct. Acceptable bacteria samples shall be taken two consecutive days. If the bacterial samples are not satisfactory, the chlorination procedure will be repeated until satisfactory samples are obtained. The Contractor will provide the necessary sampling points. All water used in testing, chlorinating and flushing will be obtained with permission from the water main Owner.

707-4.9 REMOVAL OF WATER. Removal of water, if encountered, shall be in accordance with the Removal of Water section of the General Provisions. Performance of the work described in this section is not payable directly, but shall be considered as a subsidiary obligation of the Contractor and included in the Contract price for the pay items of work involved.

707-4.10 ABANDONMENT OF EXISTING WATER LINES. Existing water line pipes indicated to be abandoned in place shall be filled with Controlled Low Strength Material in accordance with Item P-

153 if called out on the plans. The Contractor shall provide bulkheads, when necessary, to contain the material within the pipes. Upon completion of placement of the Controlled Low Strength Material, the area shall be backfilled with suitable on-site material obtained from excavation operations to the elevation of proposed subgrade or finished grade in accordance with Item P-152. No separate measurement for payment of backfilling and construction of bulkheads will be made. Backfilling and bulkhead construction are considered incidental to completion of the work and the associated costs shall be included in the unit prices bid for the items of work involved.

707-4.11 REMOVAL OF VALVES AND HYDRANT. Contractor shall remove water valves and hydrants from existing pipes to facilitate abandonment of water lines where indicated on the Plans. Removal of water valves shall also include removal of appurtenances and concrete anchors or pads which may be present. All materials removed shall be disposed of offsite. Upon completion of removal, the area shall be backfilled with suitable on-site material obtained from excavation operations to the elevation of proposed subgrade in accordance with Item P-152. No separate measurement for payment of disposal or backfilling will be made. Disposal and backfilling are considered incidental to completion of the work and the associated costs shall be included in the unit prices bid for the items of work involved.

707-4.12 REMOVAL OF EXISTING PIPE. Contractor shall remove existing pipes where indicated on the Plans. All materials removed shall be disposed of offsite. All removals shall be in accordance with Section G of the Contract Documents. Existing pipes may contain asbestos and should be handled with care and in accordance with all local, state, federal, and OSHA requirements. Upon completion of removal, the area shall be backfilled with suitable on-site material obtained from excavation operations to the elevation of proposed subgrade in accordance with Item P-152. Disposal and backfilling are considered incidental to completion of the work and the associated costs shall be included in the unit prices bid for the items of work involved.

707-5 METHOD OF MEASUREMENT.

707-5.1 Method of measurement shall be on a per linear foot basis for each size and type of pipe in place completed and approved. It shall be measured along the centerline of the pipe from end to face of valve or from end to face of hydrant valve. Measurement shall include the length of reducers, tapping sleeves and valves. Measurement for reducers shall be included in the length of the larger size pipe. Measurement of couplings and tees shall be included in the length of the associated pipe. The accepted quantities of removal of existing pipes will be paid for at the contract unit price per linear foot, completely removed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling, and placing of fill materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the Contract Drawings; and for all labor, equipment, tools and incidentals necessary to complete the removal of pipes to the satisfaction of the Engineer.

The following additional items are specifically included under Item D-707.

- All required connections
- All required excavation
- Required backfilling with on-site materials
- Dewatering if required
- Sheeting and Bracing
- Disposal of removed materials or structures

707-5.2 . Fire hydrants will be measured as complete units for each hydrant, associated gate valves, and piping necessary to make the connection to its associated water line, complete and in place, including all excavation, fittings, bracing, tests, chlorination, backfill and appurtenances.

707-6 BASIS OF PAYMENT.

707-6.1 Payment will be made at the contract unit price per linear foot for each type, size and class of pipe installed. This price shall be full compensation for furnishing all materials and for all preparation excavation and installation of these materials and for all labor, equipment, tools and incidentals necessary to complete these items. Payment shall be made at the contract unit price per linear foot for removal of existing water lines, which price and payment shall be full compensation for furnishing and placing all material, disposal of all materials, and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

707-6.2 . Payment will be made at the contract unit price for each hydrant unit complete and in place. The price shall be full compensation for furnishing all materials and for all preparation and installation of these materials and for all labor, equipment, tools and incidentals necessary to complete the item.

Payment will be made under:

Item D-707-6.1 - Water Line - per linear foot

Item D-707-6.2 - Fire Hydrant and Gate Valve with Service Connection - per each

END OF ITEM D-707

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 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, unless otherwise indicated. 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 of 50 megohms minima, (1000 V megger) per AC 150/5340-26B, Maintenance Airport Visual aid Facilities, 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.

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 C, 5,000 volts, nonshielded, with 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 C, 5,000 volts, nonshielded, with 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.

If control cable is required, a THWN cable with multi-stranded copper conductors, 300 volt, double jacket, direct burial cable shall be used unless otherwise specified. Cable size and number of conductors shall be as specified herein or shown on the plans.

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).

a. Counterpoise wire. Wire for counterpoise for airfield lighting systems shall be No. 6 AWG bare solid copper wire per ASTM B3. See AC 150/5340-30 for additional details about counterpoise and ground wire types and installation.

b. Equipment safety ground wire. Equipment safety ground wire shall be No. 6 AWG bare stranded copper wire conforming to the requirements of ASTM B8.

c. Ground wire for voltage powered circuits. For voltage powered circuits, the equipment ground conductor shall be of the size, type and insulation value shown on the plans. The insulation shall be green color.

d. Ground rods. Ground rods shall be 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) long and 5/8 inch (16 mm) in diameter.

108-2.4 Cable connections. In-line connections or splices of underground primary cables shall be of the type called for on the plans, or 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 3M™ 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.

d. The heat-shrink splice. 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 shall be in accordance with Caltrans Section 90 Concrete. Cement shall be Portland Cement Type I or Type II and obtain a minimum compressive strength of 3,000psi at 28 days.

108-2.7 Flowable backfill. Not used.

108-2.8 Cable identification tags. Existing tags shall be salvaged for reuse.

108-2.9 Tape. Plastic tapes shall meet the requirements of ASTM D 1000, such as Scotch™ Electrical Tapes –Scotch™ 88 (1-1/2 inch (38 mm) wide) as manufactured by the Minnesota Mining and Manufacturing Company, or approved equivalent. Rubber or synthetic rubber tape shall meet the requirements of ASTM D 4388, such as 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 Heat shrink tubing. 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. Heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.

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. The legend shall read "CAUTION: BURIED ELECTRIC LINE BELOW", or similar language which includes the words "CAUTION" and "ELECTRIC".

108-2.13 Bedding. Bedding shall meet the requirements of ASTM C 33, fine aggregate for concrete. Gradation shall be in accordance with the table below:

	Percentage By Weight
Sieve Designations	**Passing Sieves**
3/8 Inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	5-30
No. 100	0-10

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 no more than 1,000 feet apart, unless otherwise shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed or at least once in each access point where L-823 connectors are not installed.

Provide not less than 3 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.

Each cable installed in electrical manholes and pull boxes shall be routed at least one complete loop around the interior wall of the structure prior to exiting.

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 conduits and ducts are open, available 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. An iron-shod mandrel, not more than 1/4-inch smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole. The Contractor shall swab out all conduits/ducts and clean 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 access points of entry 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. 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 shall be placed at 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.

(3) Low voltage cables shall be placed a minimum of 12 inches from high voltage cables.

Dewatering necessary for cable installation, 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 of similar voltage insulation values 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. The Contractor shall ascertain the type of soil or rock to be excavated before bidding.

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 of damage to existing utilities or cables, the Engineer and airport authorities are to be notified immediately. The Contractor shall repair all damage, as directed by the Engineer, immediately and at the Contractor's expense.

b. Backfilling. After the cable has been installed, the trench shall be backfilled. The first layer of backfill above the cables in the trench shall be 3 inches (75 mm) deep, loose measurement of bedding, and shall not be compacted. The second layer shall be 5 inches (125 mm) deep, loose measurement of bedding. The counterpoise wire, if required, shall be placed at this time. The remaining layers of backfill shall not exceed 8 inches (20 cm), loose measurement, of suitable on-site 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.

Prior to placing topsoil, underground electrical warning (caution) tape shall be installed in the trench above all direct-buried cable, unless otherwise shown. Contractor shall submit a sample of the proposed warning tape for acceptance by the Engineer. One warning tape shall be installed for every 3 cables, or increment thereof, installed in a common trench.

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. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. Suitable material may be deposited in embankment or shoulders areas. Unsuitable material shall be disposed off airport property or as ordered by the Engineer. All areas disturbed by the Contractor's operations shall be restored to its original condition at no cost to the Owner. The restoration shall be performed in accordance with the details as shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

Where cables are installed in trenches outside of the general grading limits, or in areas that would not otherwise be disturbed, restoration shall be considered necessary and incidental to the work of this item and the costs shall be included in the associated pay items of work involved.

Where cables are installed within the general grading limits, restoration of the area will not be necessary as payment for establishment of turf will be included in the various pay items of work involved.

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.

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 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. Heat-shrink splices. A taped splice shall be made in the following manner:

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 copper counterpoise wire shall be installed for lightning protection of the underground cables, duct banks and conduits. The following method of lightning protection for the airfield lighting circuit has been selected:

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.

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. Payment will be made for each counterpoise wire installed in a counterpoise trench shown on the plans and shall include excavation, backfill, counterpoise wire, restoration, ground rods, exothermic connections and detectable warning tape.

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 which are not 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 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. Counterpoise connections shall be exothermic unless otherwise shown on the plans.

A separate equipment (safety) ground system shall be provided in addition to the counterpoise wire using one of the following methods:

a. 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 an equipment safety ground wire. At access structures, the safety ground shall be connected to all metal surfaces within the structure and attached to a ground rod. Ground wires and ground rods for equipment safety ground systems shall be considered necessary and incidental to the work of this contract and the costs shall be included in the associated pay items of work involved.

b. For parallel voltage systems, install a 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. At junction/access structures, the ground conductor shall be connected to all metal surfaces within the structure.

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.

When multiple conduits or airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits or wires shall be adequate to provide a complete cone of protection measured 22-1/2 degrees each side of vertical. One counterpoise wire shall be installed for every 3 cables, or increment thereof, installed in a common trench. One counterpoise wire shall be installed for every 2 conduits, or increment thereof, installed in a common trench.

The Contractor may choose to install cables and/or conduits in multiple trenches however, additional counterpoise wire will be required to protect the cables and/or conduits. The cost of installing additional counterpoise wire shall be borne by the Contractor.

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.

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 in accordance with Maintenance of Airport Lighting subsection of the Work Area, Storage Area, and Sequence of Operations section of the General Provisions. 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.

METHOD OF MEASUREMENT

108-4.1 Cable or counterpoise wire installed in conduit shall be measured by the number of linear feet installed and grounding connectors, ready for operation, and accepted as satisfactory. The measurement for this item shall not include additional quantities required for slack.

BASIS OF PAYMENT

108-5.1 Payment will be made at the contract unit price for cable and bare counterpoise wire installed in conduit or direct buried, and placed 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 and any and all connections, necessary to complete this item.

Payment will be made under:

Item L-108-5.1	-	No. 8 AWG, 5 kV, 1/C Airfield Lighting Cable - per linear foot
Item L-108-5.1	-	Counterpoise Wire - per linear foot

SUBMITTALS AND CERTIFICATIONS

108-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Catalogue data for each size and type of cable.
- Catalogue data for counterpoise wire.
- Catalogue data for ground rods.
- Catalogue data for cable connections.
- Catalogue data showing that detectable warning tape meets the requirements specified.

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
ANSI/IEEE STD 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

END OF ITEM L-108

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 excavation, trenching, sheeting, bracing, dewatering, backfilling, removal 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.

This item also includes removal of existing conduit and duct banks.

This item also includes restoration of paved or turf surfaces which are not otherwise disturbed as a result of the proposed work of this contact.

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 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, unless otherwise indicated. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

110-2.2 Rigid galvanized 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. PVC coated rigid galvanized steel conduit shall have a 0.04-inch thick factory applied PVC coating meeting NEMA Standard No. RN1. Fittings shall have the same coating. 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 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 be in accordance with Caltrans Section 90 Concrete. Cement shall be Portland Cement Type I or Type II and obtain a minimum compressive strength of 3,000psi at 28 days.

110-2.7 Controlled low strength material. Not used.

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. The legend shall read “CAUTION: BURIED ELECTRIC LINE BELOW”, or similar language which includes the words “CAUTION” and “ELECTRIC”.

110-2.9 Flexible conduit. Flexible conduit shall be liquid-tight non-metallic conforming to the requirements of NEC 356 and UL 1660. Fittings shall conform to UL 514B. Where connected to rigid steel or PVC conduit, the flexible conduit shall have the same inside diameter.

110-2.10 Conduit fittings. Conduit fittings shall be from the same manufacturer and of the same material

as the conduit. Fittings shall provide for liquid tight connections. The fittings inside diameter shall be the same as the conduit.

110-2.11 Reinforcing steel. Reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A 615, Grade 60. Reinforcing steel shall be hot dipped galvanized in accordance with ASTM A-123, or epoxy coated.

110-2.12 Concrete bonding agent. Concrete bonding agent shall conform to the requirements of ASTM C 881. Concrete bonding agent shall be Type V, Grade 2 and un-pigmented. Concrete bonding agent shall be Class A, B, or C, depending on the temperature of the concrete surface to which the agent will be applied.

110-2.13 Bedding. Bedding shall meet the requirements of ASTM C 33, fine aggregate for concrete. Gradation shall be in accordance with the table below:

	Percentage By Weight
Sieve Designations	**Passing Sieves**
3/8 Inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	5-30
No. 100	0-10

110-2.14 Backfill. Backfill shall be suitable on-site material obtained from the trench excavation, unless otherwise shown on the Contract Drawings.

110-2.15 Counterpoise wire. Counterpoise wire shall meet the requirements of Item L-108, Underground Cable for Airports.

110-2.16 Ground rods. Ground Rods shall meet the requirements of Item L-108, Underground Cable for Airports.

110-2.17 Concrete grouting material. This material shall have a maximum initial setting time of one hour. Compressive strength shall be a minimum of 2,000 psi after one day and 5,000 psi after 28 days. The material shall be able to withstand 25 cycles of freeze-thaw (10% NaCl) with a maximum loss of 4%. The material may exhibit expansion at no more than 0.40% and shrinkage of no more than 0.05% such that no cracks are produced. The bond strength shall be a minimum of 200 psi after 5 days air cure without the use of a special bonding agent. The material shall exhibit no appreciable heat of hydration.

110-2.18 Lining. Lining, if required, shall conform to the requirements of Caltrans Section 26 Aggregate Base. The cost of lining used for the placement and backfill of concrete encased duct banks shall be included in the cost of the duct bank.

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, unless otherwise shown. Where under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade, unless otherwise shown.

All ducts and conduit ends must be capped or plugged prior to backfilling to prevent the infiltration of soil and water.

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 1,000 pound test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent 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. Existing paved areas to be trenched shall be saw cut to a vertical face with no surface spalling prior to removal of pavement.

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.

Where existing conduits and duct banks are to be removed in the same trench as proposed conduits and duct banks, the Contractor shall consider such removal as an incidental part of construction and include the costs thereof in the various pay items involved. Where existing conduits and duct banks are to be removed outside of proposed trenching limits, they shall be paid for separately. The cost of such removal shall include excavation, conduit and duct bank removal, disposal, and backfill. Restoration shall be as specified below in the section titled "Restoration". Backfill shall be with suitable on-site material unless otherwise shown or specified. Backfill under paved areas shall be as shown on the plans. Conduit and duct banks shall be removed as shown on the plans and as directed by the Engineer. When conduit and duct banks are removed and disconnected from existing structures, the openings in the structure shall be closed watertight with brick and mortar. When conduits and duct banks are to be replaced, any structure modifications required to accept the proposed conduit and duct bank shall be done with all connections grouted watertight.

When rock is encountered, the rock shall be removed to the depths required for the conduit or duct bank and replaced with bedding or lining as shown on the plans. Flowable backfill may alternatively be used The Contractor shall ascertain the type of soil or rock to be excavated before bidding. The cost of excavation, regardless of the type of material encountered, shall be included in the various pay items involved.

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 required, the warning tape shall be at the locations indicated on the plans.

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.

The Contractor shall do all unclassified excavation to the required depths as shown on the plans.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it for the width and depths shown on the plans. The excavation below grade shall be backfilled with Caltrans Section 26 Aggregate Base.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with Caltrans Section 26 Aggregate Base for the full trench width. The Engineer shall determine the depth of removal necessary.

Excavation for conduits and duct banks that are placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the conduit and duct bank as shown on the plans.

All required excavation shall be included in the unit price bid per lineal foot for the conduit or duct bank, including rock excavation, if encountered.

The Contractor shall do such trench bracing, sheeting or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheeting or shoring shall not be removed in one operation, but shall be done in successive stages as determined by the Engineer to prevent overloading of the conduit or duct bank during backfilling operations. The cost of the bracing, sheeting or shoring and the removal of same shall be considered as a subsidiary obligation of the Contractor and included in the contract price for the pay items of work involved.

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.

The Contractor is responsible for removal of water regardless of its source. Measures shall be taken to protect the excavation from surface water runoff as well as for dewatering the excavation from any water which has entered the excavation. The cost of the removal of water shall be considered as a subsidiary obligation of the Contractor and included in the contract price for the pay items of work involved.

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 of damage to existing utilities or cables, the Engineer and airport authorities are to be notified immediately. The Contractor shall repair all damage, as directed by the Engineer, immediately and at the Contractor's expense.

110-3.2 Concrete encased 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 10 feet beyond the edges of the pavement. 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 built on prepared foundations consisting of Caltrans Section 26 aggregate base, conforming to the dimensions and form indicated on the plans. Soil below the base shall be compacted to 95% maximum density for non-cohesive soils and 90% maximum density for cohesive soils in accordance with ASTM D 698. 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 4½ inches 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 or shown, 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 soil bearing capacity is inadequate, 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. To relieve stresses on joints between concrete-encased duct banks and structure walls, reinforcement rods shall be placed in the structure wall and tied to the duct bank reinforcement at the time the duct bank is installed.

Concrete handling and placement shall be in accordance with Caltrans Section 90 Concrete. 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, above all underground conduit or duct lines not installed under pavement, at the location shown on the plans. Install one tape over each counterpoise wire.

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.

Where duct banks are being extended, or where the duct bank is structurally tied to existing concrete, Contractor shall apply a concrete bonding agent to the surface of existing concrete prior to pouring fresh concrete.

Counterpoise wire and ground rods shall be installed in accordance with Item L-108, Underground Cable for Airports.

110-3.3 Conduits without concrete encasement. Trenches for conduit lines shall be wide enough to accommodate at least 8 inches of bedding along the outer edges of the conduits. 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 bedding, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench. This layer shall not be tamped. Ducts shall be installed on the bedding in the number and spacing specified. Contractor shall place a layer of bedding that extends at least 3 inches, loose measurement, above the top of the duct. In the case where ducts are "stacked", the layer shall be placed at 6 inches above the underlying conduit. This layer shall be tamped prior to installing the subsequent layer of conduits. After placing all the bedding material, Contractor shall thoroughly tamp and compact the bedding 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. Item P-153, Controlled Low Strength Material may alternatively be used for bedding provided it is used for backfill as described below.

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.

Where two or more individual conduits 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 lot less than 6 inches (150 mm) apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (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.

Counterpoise wire and ground rods shall be installed in accordance with Item L-108, Underground Cable for Airports.

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 bedding shall be placed along the sides of the conduits and 3 inches over the top of the conduits and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled with suitable on-site material, unless otherwise shown, 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.

Item P-153, Controlled Low Strength Material may alternatively be used for backfill provided the same material is used for bedding below the conduits as described above.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped; except that, where topsoil or sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the topsoil or 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. Backfill shall not be placed against any concrete encased ducts until the concrete has been in place for seven days, or until tests made by the laboratory, under supervision of the Engineer, determines that the concrete has reached a compressive strength of 2,000 psi. The remaining trench shall be backfilled with lining and compacted per Item D-711 "Lining", or with suitable on-site material 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. 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.

Item P-153, Controlled Low Strength Material may alternatively be used in lieu of suitable n-site material.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and compacted. Where topsoil or sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the topsoil or 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. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. Suitable material may be deposited in embankment or shoulders areas. Unsuitable material shall be disposed off airport property or as ordered by the Engineer.

All areas disturbed by the Contractor's operations shall be restored to its original condition at no cost to the Owner. Restoration of surfaces shall be performed in accordance with the details shown on the plans. Where conduits or duct banks are installed or removed outside of the general grading limits, or in areas that would not otherwise be disturbed, restoration shall be considered necessary and incidental to the work of this item and the costs shall be included in the associated pay items of work involved.

Where conduits or duct banks are installed or removed within the general grading limits, restoration of the area will not be necessary as payment for establishment of turf or pavement will be included in the various pay items of work involved.

The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. 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.

110-4.8 Grouting conduits in pavement. Conduit trenches in pavement to receive concrete grout material shall be thoroughly cleaned to the satisfaction of the Engineer prior to placement of grout material. Trench sides shall be saw cut to a vertical face with no surface spalling. Grout material shall be placed to the depths shown on the Contract Drawings. Grouting conduits in pavement shall be considered

necessary and incidental to the work of this item and the costs shall be included in the various pay items involved.

METHOD OF MEASUREMENT

110-4.1 Underground conduits shall be measured by the linear feet of conduits installed, including encasement, locator tape, trenching and backfill with designated material, for drain lines, and for the termination at the structure, all measured in place from the end or inside face of structure to end or inside face of structure, 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, for drain lines, and for the termination at the 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	2-Inch Dia. PVC Conduit in Turf - per linear foot
Item L-110-5.1	2-Inch Dia. RGS Conduit in Pavement - per linear foot
Item L-110-5.2	2-Way Duct Bank with 2” Conduit – per linear foot

SUBMITTALS AND CERTIFICATIONS

110-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Catalogue data for PVC conduit.
- Catalogue for conduit spacers
- Catalogue data for detectable warning tape.
- Catalogue data for flexible conduit.
- Certification for reinforcing steel
- Material certification and gradation sieve analysis for bedding
- Lining in accordance with Caltrans Section 26 Aggregate Base.
- Counterpoise wire in accordance with Item L-108

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

Item L-125 Airport Lighting Systems

DESCRIPTION

125-1.1 This item shall consist of runway and taxiway edge lighting systems, runway centerline and touchdown zone lighting systems, taxiway lighting systems, runway and taxiway guidance signs, runway distance remaining signs, and economy approach lighting aids furnished and installed in accordance with this specification, referenced specifications and applicable Advisory Circulars. The lighting systems, signs and approach lighting aids shall be installed at the locations and in accordance with the dimensions, design, and details shown in the Contract Drawings. This item shall include all excavation, backfilling, and restoration of surfaces and the furnishing of all equipment, materials, services, and incidentals necessary to place the systems in operation as completed units to the satisfaction of the Engineer.

Where indicated on the Contract Drawings, this item shall also include the removal, modification, or relocation of existing lights, signs and approach lighting aids.

125-1.2 Additional details pertaining to a specific systems covered in this specification are contained in the Advisory Circulars 150/5340-30, Design and Installation Details for Airport Visual Aids and 150/5340-18, Standards for Airport Sign Systems.

EQUIPMENT AND MATERIALS

125-2.1 GENERAL.

- **a.** Airport lighting equipment and materials covered by Federal Aviation Administration Specifications shall be certified in accordance with Advisory Circular 150/5345-53, Airport Lighting Equipment Certification Program, latest edition.

- **b.** All other equipment and materials covered by other referenced Specifications shall be subject to acceptance through the manufacturer's certification of compliance with the applicable Specifications.

- **c.** Lists of the equipment and materials required for a particular system are contained in the applicable Advisory Circulars.

- **d.** Contractor shall have experience installing airport lights, signs and approach lighting aids or the manufacturer's representative shall be on-site during installation. Experience shall be documented by the Contractor by providing the Engineer with a list of three previous installations of the equipment being installed.

125-2.2 LIGHT BASES. Light bases shall be either L-867 (non-load bearing) bases or L-868 (load bearing) bases encased in concrete as shown on the Contact Drawings. Light bases shall be Class IA (metallic) and Size B (12 inch dia.), C (15 inch dia.), D (16 inch dia.) or E (24 inch dia.) as shown on the Contract Drawings. The bases shall have gaskets and stainless steel hardware.

125-2.3 WIRE. Wire shall be in accordance with Item L-108, Underground Cable for Airports. The wires shall be of the type, size, number of conductors, and voltage shown in the Contract Drawings or in the proposal.

125-2.4 TAPE. Plastic tape shall meet the requirements of ASTM D 1000, such as Scotch Electrical Tapes – number Scotch 88 (1-1/2” wide) as manufactured by the Minnesota Mining and Manufacturing Company, or approved equivalent. Rubber or synthetic rubber tape shall meet the requirements of ASTM

D 4388, such as Scotch 130C linerless rubber splicing tape (2" wide), as manufactured by the Minnesota Mining and Manufacturing Company, or approved equivalent.

125-2.5 POWER ADAPTER. Power adapters for approach lighting aids shall operate on an input of 2.8 to 6.6 amps, 60 Hz with an output of 120/240 VAC $\pm$3 percent over entire input range. Maximum power output shall be 670 VA. Adapter shall be of water tight construction for direct earth burial.

125-2.6 CONCRETE. Concrete shall be in accordance with Caltrans Section 90 Concrete. Cement shall be Portland Cement Type I or Type II and obtain a minimum compressive strength of 3,000psi at 28 days.

125-2.7 REINFORCING STEEL. All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A 615, Grade 60.

125-2.8 ANCHOR BOLTS AND CONCRETE ANCHOR STUDS. Anchor bolts and concrete anchor studs shall be sized in accordance with the equipment manufacturer's requirements. Anchor bolts and studs less than 3/4 inch in diameter shall be stainless steel.

125-2.9 CONDUIT. Conduit shall be in accordance with Item L-110, Airport Underground Electrical Duct Banks and Conduits.

125-2.10 WATER TIGHT TERMINATION. Water tight terminations for conduits, ducts, nipples, equipment and bases shall be mechanical compression type and shall be sized for the application and number of conductors.

125-2.11 LANDSCAPE FABRIC. The landscape fabric shall be non-woven conforming to the physical properties listed below. All property values, except apparent opening size, represent the minimum average roll value in the weaker principal direction.

Properties	**Test Method**	**Requirement**
Grab Strength @ 50% or greater elongation OR Grab Strength @ less than 50% elongation	ASTM D 4632 ASTM D 4632	110 pounds (Min.) 180 pounds (Min.)
Trapezoid Tear Strength	ASTM D 4533	40 pounds (Min.)
Puncture Strength	ASTM D 6241	222 pounds (Min.)
Permittivity	ASTM D 4491	0.10 sec^{-1} (Min.)
Apparent Opening Size	ASTM D 4751	0.60 mm (No. 30) (max avg. roll value)

125-2.12 CRUSHED STONE. Crushed Stone shall meet the requirements of Caltrans Section 26

125-2.13 BEDDING. Bedding shall meet the requirements of ASTM C 33, fine aggregate for concrete. Gradation shall be in accordance with the table below:

Sieve Designations	Percentage By Weight Passing Sieves
3/8 Inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	5-30
No. 100	0-10

125-2.14 IDENTIFICATION TAGS. Identification tags shall be a 2 inch diameter disk of non-corrosive copper based metal with numbers permanently stamped or engraved on the surface.

CONSTRUCTION METHODS

125-3.1 GENERAL. The installation and testing details for the systems shall be as specified in the applicable Advisory Circulars, manufacturer's requirements and as shown on the Contract Drawings or directed by the Engineer. Excerpts of Electrical Notes from AC 150/5340-30F are included at the end of this specification.

Exposed and buried bolts and connections that must be removed for maintenance shall be coated with an anti-seizing compound to facilitate removal.

125-3.2 EXCAVATION. All excavation shall be considered unclassified excavation. Unclassified excavation shall consist of the excavation of all material, regardless of its nature and the disposal of all such material as directed by the Engineer.

A. The Contractor shall do all excavation for airport lights, signs and navigational system installations to the lines and grades or elevations shown on the Contract Drawings or as directed by the Engineer. The excavation shall be of sufficient size to permit the placing of the airport lights, signs or navigational system.

B. Boulders, logs or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation and excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

C. The Contractor shall do all bracing, sheeting or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheeting or shoring shall be included in the unit price bid for the structure. All trench bracing, sheeting and shoring shall be in accordance with the Sheeting and Bracing section of the General Provisions.

D. 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 which will not disturb or mar finished masonry. The cost of removal shall be included in the unit bid for that item.

125-3.3 CONCRETE. Concrete handling and placement shall be in accordance with Caltrans Section 90 Concrete.

125-3.4 BACKFILLING. Backfilling around structures shall not be commenced until directed by the Engineer. Prior to backfilling, all conduits and openings shall be sealed water tight. Backfill shall be placed evenly and simultaneously on all sides of structures in 6-inch lifts. All structures shall be backfilled to the lines and grades shown on the Contract Drawings, or as required for proper operation of the airport lights, signs or navigation system and as directed by the Engineer. Contractor shall use previously excavated material if it is suitable for backfill, or if additional material is required for backfill, the Contractor shall provide suitable backfill. All materials used for backfill shall be approved in advance by the Engineer. No direct payment will be made for backfill material or its placement.

125-3.5 PLACING LIGHTS, SIGNS AND APPROACH LIGHTING AIDS. The airport lights, signs or approach lighting aids shall be installed at the approximate location indicated in the Contract Drawings. The exact location shall be as directed by the Engineer. The lights, signs or shall be installed in accordance with the Contract Drawings and the manufacturer's recommendations.

Contractor's surveyor shall be on-site during installation of approach lighting aids to verify elevations, alignment and sighting angles of approach lighting aids prior to energizing the equipment. Any deviations shall be corrected by the Contractor and verified by the surveyor before the equipment is put to service.

Contractor shall attach a light unit identification tag to each light unit, sign, wind cone, navigational system and other fixture connected to the circuit where indicated on the Contract Drawings. ID tags shall be securely attached with a set screw or non-corrosive wire band. The light unit ID tags shall be sequentially numbered and attached to the fixtures in the order in which the lights are connected to the circuit. Light unit identification tags shall be considered necessary and incidental to the work of this item and the costs shall be included in the associated pay items of work involved.

Contractor shall have experience installing approach lighting aids, or the manufacturer's representative shall be onsite during installation. Experience shall be documented by the Contractor by providing the Engineer with a list of three previous installations of the equipment being installed.

125-3.6 REMOVAL OF LIGHTS, SIGNS AND APPROACH LIGHTING AIDS. Where existing lights, signs and approach lighting aids are to be removed in the same location as proposed fixtures, the Contractor shall consider such removal as an incidental part of construction and include the costs thereof in the various pay items of work involved. Where existing lights, signs and approach lighting aids are to be removed at locations where a new fixture is not being placed, removal shall be paid for separately. The cost of such removal shall include excavation, removal of fixture and foundation, backfilling, disposal of existing fixture, and restoration. Lights, signs and approach lighting aids shall be removed from the locations shown on the Contract Drawings, unless otherwise directed by the Engineer.

125-3.7 RESTORATION. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. Suitable material may be deposited in embankment or shoulders areas. Unsuitable material shall be disposed of off airport property or as ordered by the Engineer.

Areas disturbed by the Contractor’s operation shall be restored to their original condition. Restoration of surfaces shall be performed in accordance with the details of the Contract Drawings.

Where airport lights, signs or approach lighting aids are installed or removed outside of the general grading limits, or in areas that would not otherwise be disturbed, restoration shall be considered necessary

and incidental to the work of this item and the costs shall be included in the associated pay items for airport lights, signs or approach lighting aids installed or removed.

Where airport lights, signs or approach lighting aids are installed or removed within the general grading limits, restoration of the area will not be necessary as payment for establishment of turf or pavement will be included in the various pay items of work involved.

The Contractor shall be responsible for maintaining all disturbed surfaces and restorations until final acceptance.

125-3.8 INSTALLATION OF CABLES AND CONDUITS. Excavation for trenches, backfilling, furnishing and installation of cables and conduits shall be performed in accordance with Items L-108, Underground Cable for Airports and L-110, Airport Underground Electrical Duct Banks and Conduits.

125-3.9 INSTALLATION OF RETROREFLECTIVE MARKERS. Not Used.

125-3.10 SPOIL MATERIAL. The owner has first rights to salvage any electrical equipment removed. Contractor shall separate useable equipment from unusable equipment. The equipment to be salvaged shall be stockpiled at a location designated by the owner in proper working condition. All other materials shall be spoiled off airport property at a proper disposal site.

125-3.11 BRIGHTNESS ADJUSTMENTS FOR INTERNALLY LIGHTED GUIDANCE SIGNS. Upon completion of the sign installation, the contractor shall make necessary brightness adjustment for each sign unit. The contractor shall make the required adjustments in accordance with the manufacturer's printed instructions.

125-3.12 AIMING, FLIGHT CHECK AND NOTIFICATION FOR APPROACH LIGHTING AIDS. Not Used.

125-3.13 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 and results meeting the specifications below must be maintained by the Contractor throughout the entire project as well as during the ensuing warranty period.

Earth resistance testing methods shall be submitted to the Engineer for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the Engineer. All such testing shall be at the sole expense of the Contractor.

Should 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.

The test equipment for insulation resistance shall be an insulation resistance tester (1,000V megger) with a digital readout. The instrument shall provide a 500 volt test for insulation resistance with a meter range of 0 to 500 megohms.

After installation, the Contractor shall test and demonstrate to the satisfaction of the Engineer the following:

a. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.

b. That all affected circuits (existing and new) are free from unspecified grounds.

c. That the insulation resistance to ground of all new non-grounded series circuits or cable segments is not less than 50 megohms.

d. That the insulation resistance to ground of all non-grounded conductors of new multiple circuits or circuit segments is not less than 50 megohms.

e. That all affected circuits (existing and new) are properly connected in accordance with applicable wiring diagrams.

f. That all affected circuits (existing and new) are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.

g. That the impedance to ground of each ground rod does not exceed 25 ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test shall be used, as described by ANSI/IEEE Standard 81, to verify this requirement.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the Engineer. Where connecting new cable to existing cable, ground resistance tests shall be performed on the new cable prior to connection to the existing circuit

There are no approved "repair" procedures for items that have failed testing other than complete replacement.

METHOD OF MEASUREMENT

125-4.1 The quantity of lights to be paid for under this item shall be the number of each type installed as completed units in place, ready for operation and accepted by the Engineer.

125-4.2 The quantity of removal, modification or relocation of existing lights, signs or navigational system to be paid for under this item shall be the number of each type completely removed, modified or relocated, including relocation of step down transformer, enclosure, control bar and construction of a new foundation (where applicable) and appurtenances and reinstated as completed units, in place, ready for operation, as shown on the Contract Drawings.

BASIS OF PAYMENT

125-5.1 Payment will be made at the Contract unit price for each complete light, sign, or navigational system installed in place by the Contractor and accepted by the Engineer. This price shall be full compensation for all excavation and backfilling, 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.

125-5.2 Payment will be made at the Contract unit price for each light, sign or navigational system completely removed, modified or relocated and accepted by the Engineer. This price shall be full compensation for all excavation and backfilling, furnishing all materials and for all preparation disassembly, reassembly, realignment and installation of these materials and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Item L 125-5.1	Medium Intensity Taxiway Light, Base Mounted - per each
Item L 125-5.1	Medium Intensity Taxiway Light, In-Pavement - per each
Item L-125-5.2	Removal of Existing Elevated Edge Light - per each

SUBMITTALS AND CERTIFICATIONS

125-6.1 The following "Shop and Setting Drawings", "Working Drawings", Catalogue Data" and "Certifications" shall be submitted for review:

- Evidence of Contractor's experience installing lighting and approach lighting aids.
- Catalog data showing the light units, including all components which are used to assemble the equipment, meets the requirements specified.
- Gradation sieve analysis for bedding.
- Caltrans Concrete Mix Design.
- Submittal for conduit in accordance with Item L-110.
- Catalog data for landscape fabric meeting the requirements specified.

EXCERPTS FROM AC 150/5340-30F, Appendix 5

A5-1. Electrical Notes

a. General

(1) The electrical installation, at a minimum, must meet the NEC and local regulations.

(2) The contractor must ascertain that all lighting system components furnished (including FAA approved equipment) are compatible in all respects with each other and the remainder of the new/existing system. Any non-compatible components furnished by the contractor must be replaced at no additional cost to the airport sponsor with a similar unit that is approved by the engineer and compatible with the remainder of the airport lighting system.

(3) In case the contractor elects to furnish and install airport lighting equipment requiring additional wiring, transformers, adapters, mountings, etc., to those shown on the drawings and/or listed in the specifications, any cost for these items must be incidental to the equipment cost.

(4) The contractor-installed equipment (including FAA approved) must not generate any EMI in the existing and/or new communications, weather, air navigation, and ATC equipment. Any equipment generating such interference must be replaced by the contractor at no additional cost with equipment meeting the applicable specifications.

(5) When a specific type, style, class, etc., of FAA approved equipment is specified only that type, style, class, etc., will be acceptable, though equipment of other types, style, class, etc., may be FAA approved.

(6) Any and all instructions from the engineer to the contractor regarding changes in, or deviations from, the plans and specifications must be in writing with copies sent to the airport sponsor and the FAA field office (Airports District Office (ADO)/Airports Field Office (AFO)). The contractor must not accept any verbal instructions from the engineer regarding any changes from the plans and specifications.

(7) A minimum of three copies of instruction books must be supplied with each type of equipment. For more sophisticated types of equipment, such as regulators, PAPI, REIL, etc., the instruction book must contain the following:

(a) A detailed description of the overall equipment and its individual components.

(b) Theory of operation including the function of each component.

(c) Installation instructions.

(d) Start-up instructions.

(e) Preventative maintenance requirements.

(f) Chart for troubleshooting.

(g) Complete power and control detailed wiring diagram(s), showing each conductor/connection/component -"black" boxes are not acceptable. The diagram or the narrative must show voltages/currents/wave shapes at strategic locations to be used when checking and/or troubleshooting the equipment. When the equipment has several brightness steps, these parameters must be indicated for all the different modes.

(h) Parts list will include all major and minor components, such as resistors, diodes, etc. It must include a complete nomenclature of each component and, if applicable, the name of its manufacturer and the catalog number.

(i) Safety instructions.

b. (Not Applicable)

c. Field lighting

(1) Unless otherwise stated, all underground field power multiple and series circuit conductors (whether **direct earth burial (DEB**) or in duct/conduit) must be FAA approved Type L-824. Insulation voltage and size must be as specified.

(2) No components of the primary circuit such as cable, connectors and transformers must be brought above ground at edge lights, signs, REIL, etc.

(3) There must be no exposed power/control cables between the point where they leave the underground (DEB or L-867 bases) and where they enter the equipment (such as taxiway signs, PAPI, REIL, etc.). Enclosures. These cables must be enclosed in rigid conduit or in flexible

water-tight conduit with frangible coupling(s) at the grade or the housing cover, as shown in applicable details.

(4) The joints of the L-823 primary connectors must be wrapped with 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, as shown in Figure 122.

(5) The cable entrance into the field attached L-823 connectors must be enclosed by heat shrinkable tubing with continuous internal adhesive as shown in Figure 122.

(6) The ID of the primary L-823 field attached connectors must match the cable OD to provide a watertight cable entrance. The entrance must be encapsulated in heat shrinkable tubing with continuous factory applied internal adhesive, as shown in Figure 122.

(7) L-823 type 11, two-conductor secondary connector must be class "A" (factory molded).

(8) There must be no splices in the secondary cable(s) within the stems of a runway/taxiway edge/threshold lighting fixtures and the wireways leading to taxiway signs and PAPI/REIL equipment.

(9) Electrical insulating grease must be applied within the L-823, secondary, two conductor connectors to prevent water entrance. The connectors must not be taped.

(10) DEB isolation transformers must be buried at a depth of 10 inches (254 mm) on a line crossing the light and perpendicular to the runway/taxiway centerline at a location 12 inches (305 mm) from the light opposite from the runway/taxiway.

(11) DEB primary connectors must be buried at a depth of 10 inches (254 mm) near the isolation transformer. They must be orientated parallel with the runway/taxiway centerline. There must be no bends in the primary cable 6 inches (152 mm), minimum, from the entrance into the field-attached primary connection.

(12) A slack of 3 ft. (0.9 m), minimum, must be provided in the primary cable at each transformer/connector termination. At stake-mounted lights, the slack must be loosely coiled immediately below the isolation transformer.

(13) Direction of primary cables must be identified by color coding as follows when facing light with back facing pavement: cable to the left is coded red and cable to the right is coded blue, this applies to the stake-mounted lights and base-mounted lights where the base has only one entrance.

(14) L-867 bases must be size B, 24" (610 mm) deep class 1 unless otherwise noted.

(15) Base-mounted frangible couplings must not have weep holes to the outside. Plugged holes are not acceptable. The coupling must have a 1/4" (6 mm) diameter minimum or equivalent opening for drainage from the space around the secondary connector into the L-867 base.

(16) The elevation of the frangible coupling groove must not exceed 1-1/2" (38 mm) above the edge of the cover for base-mounted couplings or the top of the stake for stake-mounted couplings.

(17) Where the frangible coupling is not an integral part of the light fixture stem or mounting leg, a bead of silicone rubber seal must be applied completely around the light stem or wireway at the frangible coupling to provide a watertight seal.

(18) Tops of the stakes supporting light fixtures must be flush with the surrounding grade.

(19) Plastic lighting fixture components, such as lamp heads, stems, frangible couplings, base covers, brackets, stakes, are not acceptable. L-867 plastic transformer housings are acceptable. A metal threaded fitting must be set in flange during casting process. Base cover bolts must be fabricated from 18-8 stainless steel.

(20) The tolerance for the height of runway/taxiway edge lights must be ± 1 inch (25 mm). For stake-mounted lights, the specified lighting fixture height must be measured between the top of the stake and the top of the lens. For base-mounted lights, the specified lighting fixture height must be measured between the top of the base flange and the top of the lens, and includes the base cover, the frangible coupling, the stem, the lamp housing and the lens.

(21) The tolerance for the lateral spacing (light lane to runway/taxiway centerline) of runway/taxiway edge lights must be ± 1 inch (25.4 mm). This also applies at intersections to lateral spacing between lights of a runway/taxiway and the intersecting runway/taxiway.

(22) L-867 bases may be precast. Entrances into L-867 bases must be plugged from the inside with duct seal.

(23) Galvanized/painted equipment/component surfaces must not be damaged by drilling, filing, etc. – this includes drain holes in metal transformer housings.

(24) Edge light numbering tags must be facing the pavement.

(25) Cable/splice/duct markers must be pre-cast concrete of the size shown. Letters/numbers/arrows for the legend to be impressed into the tops of the markers must be pre-assembled and secured in the mold before the concrete is poured. Legends inscribed by hand in wet concrete are not acceptable.

(26) All underground cable runs must be identified by cable markers at 200 ft. (61 m) maximum spacing with an additional marker at each change of direction of the cable run. Cable markers must be installed above the cable.

(27) Locations of all DEB underground cable splice/connections, except those at isolation transformers, must be identified by splice markers. Splice markers must be placed above the splice/connections.

(28) The cable and splice markers must identify the circuits to which the cables belong. For example: RWY 4-22, PAPI-4, PAPI-22.

(29) Locations of ends of all underground ducts must be identified by duct markers.

(30) The preferred mounting method of runway and taxiway signs is by the use of single row of legs. However, two rows will be acceptable.

(31) Reference Figure 126 and Figure 127 for an example of a lighted sign installation.

a. Power to the sign must be provided through breakaway cable connectors installed within the frangible point portion of the sign's mounting legs.

b. There must be no above ground electrical connection between signs in a sign array.

(32) Stencil horizontal and vertical aiming angles on each REIL flash head or equipment enclosure. The numerals must be black and one inch (25 mm) minimum height.

(33) Stencil vertical aiming angles on the outside of each PAPI lamp housing. The numerals must be black and one inch (25 mm) minimum height.

(34) All power and control cables in man/hand holes must be tagged. Use embossed stainless steel strips or tags attached at both ends of the cable by the use of UV resistant plastic straps. A minimum of two tags must be provided on each cable in a man/hand hole - one at the cable entrance, and one at the cable exit.

(35) Apply a corrosion inhibiting, anti-seize compound to all screws, nuts and frangible coupling threads. If coated bolts are used per Engineering Brief #83, do not apply anti-seize compound.

(36) There must be no splices between the isolation transformers and the light unit or sign. L-823 connectors are allowed at transformer connections only, unless shown otherwise.

(37) DEB splices in home runs must be of the cast type, unless shown otherwise.

(38) Where a parallel, constant voltage PAPI system is provided, the "T" splices must be of the cast type.

d. Equipment Grounding

(1) Ground all non-current-carrying metal parts of electrical equipment by using conductors sized and routed per NEC Handbook, Article 250.

(2) All ground connections to ground rods, busses, panels, etc., must be made with pressure type solderless lugs and ground clamps. Soldered or bolt and washer type connections are not acceptable. Clean all metal surfaces before making ground connections. Exothermic welds are the preferred method of connection to a ground rod

(3) Tops of ground rods must be 6 inches (152 mm) below grade.

(4) The resistance to ground of the vault grounding system with the commercial power line neutral disconnected must not exceed 10 ohms.

(5) The resistance to ground of the counterpoise system, or at isolation locations, such as airport beacon must not exceed 25 ohms.

FEDERAL SPECIFICATIONS

Number Title

WW-C-581	Conduit, Metal Rigid; and Coupling, Elbow; and Nipple, Electrical Conduit: Zinc-coated.

FAA SPECIFICATIONS

Number	Title
AC 150/5340-30	Design and Installation Details for Airport Visual Aids.
AC 150/5340-18	Taxiway Guidance Sign System.
AC 150/5345-53	Airport Lighting Equipment Certification Program.
AC 150/5345-42	FAA Specification L-867, Airport Light Bases, Transformer Housing and Junction Boxes.
AC 150/5345-44	Specification for Runway and Taxiway Signs.

END OF ITEM L-125

Item F-162 Chain-Link Fence

DESCRIPTION

162-1.1 This item shall consist of the removal of a chain-link fence in accordance with these specifications, the details shown on the plans, and in conformity with the lines and grades shown on the plans or established by the Engineer.

THIS SPECIFICATION IS ONLY FOR THE EXISTING FENCE CALLED TO BE REMOVED.

CONSTRUCTION METHODS

162-3.1 Clearing fence line. All trees, brush, stumps, logs, and other debris which would interfere with the proper construction of the fence in the required location shall be removed a minimum width of feet on each side of the fence centerline in accordance with Item P-151, Clearing and Grubbing before starting fencing operations. The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction.

162-3.2 Removal of existing fence. Existing fence locations and quantities shall be field verified by the Contractor and approved by the Engineer prior to removal. Fence removal shall include removal of the entire fence regardless of its size, including fabric, posts, foundations, gates and all appurtenances. Holes left after fence removal shall be restored to a condition equal to or better that the surrounding area. No separate measurement for payment shall be made for restoration after fence removal. Restoration after fence removal shall be considered incidental to the work involved and the costs shall be included in the various pay items involved.

162-3.3 Spoil material. All materials shall be spoiled off airport property at a proper disposal site.

METHOD OF MEASUREMENT

162-4.1 Chain-link fence will be measured for payment by the linear foot for each type and size of fence removed. Measurement will be along the top of the fence from center to center of end posts.

BASIS OF PAYMENT

162-5.1 Payment will be made at the contract unit price per linear foot for removal of existing chain link fence. This price shall be full compensation for all removal, handling and disposal of the existing fence and appurtenances and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Item F-162	Chain Link Fence – per linear foot

MATERIAL REQUIREMENTS

ASTM A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A123	Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491	Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A824	Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM A1011	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High Strength Low Alloy with Improved Formability, and Ultra High Strength
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B221	Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM F668	Standard Specification for Polyvinyl Chloride(PVC), Polyolefin and other Organic Polymer Coated Steel Chain-Link Fence Fabric
ASTM F1043	Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F1183	Standard Specification for Aluminum Alloy Chain Link Fence Fabric
ASTM F1345	Standard Specification for Zinc 5% Aluminum-Mischmetal Alloy Coated Steel Chain-Link Fence Fabric
ASTM G152	Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM G155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials
FED SPEC RR-F-191/3	Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)

FED SPEC RR-F-191/4 Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

FAA-STD-019 Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment

END OF ITEM F-162