



**Siskiyou County, California
Weed Airport**

Volume II Technical Specifications

Issued for Bid

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Taxiway and Apron Reconstruction Project – Phase 2

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Sponsor: County of Siskiyou

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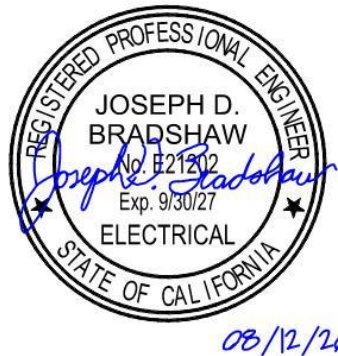
These Specifications have been prepared under the direction of the following Registered Engineer(s). It is the professional opinion of the following Registered Engineers that, to the extent that these Specifications have been prepared in reliance upon the recommendations, conclusions, and determinations of technical specialists providing engineering data, those technical specialists possess the required qualifications.

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Part 1 – General Contract Provisions

Section 10 Definition of Terms

When 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 defined as follows:

Subsection Number	Term	Definition
10-01	AASHTO	The American Association of State Highway and Transportation Officials.
10-02	Access Road	The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public roadway.
10-03	Advertisement	A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.
10-04	Airport	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; airport buildings and facilities located in any of these areas, and a heliport.
10-05	Airport Improvement Program (AIP)	A grant-in-aid program, administered by the Federal Aviation Administration (FAA).
10-06	Air Operations Area (AOA)	The term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.
10-07	Apron	Area where aircraft are parked, unloaded or loaded, fueled and/or serviced.
10-08	ASTM International (ASTM)	Formerly known as the American Society for Testing and Materials (ASTM).

Subsection Number	Term	Definition
10-09	Award	The Owner's notice to the successful bidder of the acceptance of the submitted bid.
10-10	Bidder	Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
10-11	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.
10-12	Calendar Day	Every day shown on the calendar.
10-13	Certificate of Analysis (COA)	The COA is the manufacturer's Certificate of Compliance (COC) including all applicable test results required by the specifications.
10-14	Certificate of Compliance (COC)	The manufacturer's certification stating that materials or assemblies furnished fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer's authorized representative.
10-15	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 work within the scope of the contract and necessary to complete the project.
	Construction Manager	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor, and acting directly or through an authorized representative.
10-16	Contract	A written agreement between the Owner and the Contractor that establishes the obligations of the parties including but not limited to performance of work, furnishing of labor, equipment and materials and the basis of payment. The awarded contract includes but may not be limited to: Advertisement, Contract form, Proposal, Performance bond, payment bond, General provisions, certifications and representations, Technical Specifications, Plans, Supplemental Provisions, standards incorporated by reference and issued addenda.

Subsection Number	Term	Definition
10-17	Contract Item (Pay Item)	A specific unit of work for which a price is provided in the contract.
10-18	Contract Time	The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.
10-19	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.
10-20	Contractors Quality Control (QC) Facilities	The Contractor's QC facilities in accordance with the Contractor Quality Control Program (CQCP).
10-21	Contractor Quality Control Program (CQCP)	Details the methods and procedures that will be taken to assure that all materials and completed construction required by the contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors.
10-22	Control Strip	A demonstration by the Contractor that the materials, equipment, and construction processes results in a product meeting the requirements of the specification.
10-23	Construction Safety and Phasing Plan (CSPP)	The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.
10-24	Drainage System	The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.
10-25	Engineer	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.
10-26	Equipment	All machinery, together with the necessary supplies for upkeep and maintenance; and all tools and apparatus

Subsection Number	Term	Definition
		necessary for the proper construction and acceptable completion of the work.
10-27	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 Owner's Engineer or Resident Project Representative (RPR) to be necessary to complete the work within the intended scope of the contract as previously modified.
10-28	FAA	The Federal Aviation Administration. When used to designate a person, FAA shall mean the Administrator or their duly authorized representative.
10-29	Federal Specifications	The federal specifications and standards, commercial item descriptions, and supplements, amendments, and indices prepared and issued by the General Services Administration.
10-30	Force Account	a. Contract Force Account - A method of payment that addresses extra work performed by the Contractor on a time and material basis. b. Owner Force Account - Work performed for the project by the Owner's employees.
	Ground Support Equipment	Airport ground support equipment (GSE) is used to service airplanes between flights. Services include refueling, towing airplanes or luggage/freight carts, loading luggage/freight, transporting passengers, loading potable water, removing sewage, loading food, de-icing airplanes, and fire-fighting. See also Electric Ground Support Equipment (eGSE).
10-31	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 and/or Resident Project Representative (RPR) 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 and/or RPR, subject in each case to the final determination of the Owner. Any reference to a specific requirement of a numbered subsection of the contract specifications or a cited standard shall be interpreted to include all general requirements of

Subsection Number	Term	Definition
		the entire section, specification item, or cited standard that may be pertinent to such specific reference.
10-32	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.
10-33	Major and Minor Contract Items	A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.
10-34	Materials	Any substance specified for use in the construction of the contract work.
10-35	Modification of Standards (MOS)	Any deviation from standard specifications applicable to material and construction methods in accordance with FAA Order 5300.1.
10-36	Notice to Proceed (NTP)	A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.
10-37	Owner	The term "Owner" shall mean the party of the first part or the contracting agency signatory to the contract. Where the term "Owner" is capitalized in this document, it shall mean airport Sponsor only. The Owner for this project is Siskiyou County, California.
10-38	Passenger Facility Charge (PFC)	Per 14 Code of Federal Regulations (CFR) Part 158 and 49 United States Code (USC) § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.
10-39	Pavement Structure	The combined surface course, base course(s), and subbase course(s), if any, considered as a single unit.
10-40	Payment bond	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.
10-41	Performance bond	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will

Subsection Number	Term	Definition
		complete the work in accordance with the terms of the contract.
10-42	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. Plans may also be referred to as 'contract drawings.'
10-43	Project	The agreed scope of work for accomplishing specific airport development with respect to a particular airport.
10-44	Proposal	The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.
10-45	Proposal guaranty	The security furnished with a proposal to guarantee that the bidder will enter into a contract if their own proposal is accepted by the Owner.
10-46	Quality Assurance (QA)	Owner's responsibility to assure that construction work completed complies with specifications for payment.
10-47	Quality Control (QC)	Contractor's responsibility to control material(s) and construction processes to complete construction in accordance with project specifications.
10-48	Quality Assurance (QA) Inspector	An authorized representative of the Engineer and/or Resident Project Representative (RPR) assigned to make all necessary inspections, observations, tests, and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.
10-49	Quality Assurance (QA) Laboratory	The official quality assurance testing laboratories of the Owner or such other laboratories as may be designated by the Engineer or RPR. May also be referred to as Engineer's, Owner's, or QA Laboratory.
10-50	Resident Project Representative (RPR)	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor, and acting directly or through an authorized representative.

Subsection Number	Term	Definition
10-51	Runway	The area on the airport prepared for the landing and takeoff of aircraft.
10-52	Runway Safety Area (RSA)	A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft. See the construction safety and phasing plan (CSPP) for limits of the RSA.
10-53	Safety Plan Compliance Document (SPCD)	Details how the Contractor will comply with the CSPP.
10-54	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.
10-55	Sponsor	A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.
10-56	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; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
10-57	Subgrade	The soil that forms the pavement foundation.
10-58	Superintendent	The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the RPR, and who shall supervise and direct the construction.
10-59	Supplemental Agreement	A written agreement between the Contractor and the Owner that establishes the basis of payment and contract time adjustment, if any, for the work affected by the supplemental agreement. A supplemental agreement is required if: (1) in scope work would increase or decrease the total amount of the awarded contract by more than 25%; (2) in scope work would increase or decrease the total of any major contract item by more than 25%; (3) work that is not within the scope of the originally awarded contract; or (4) adding or deleting of a major contract item.

Subsection Number	Term	Definition
10-60	Surety	The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.
10-61	Taxilane	A taxiway designed for low speed movement of aircraft between aircraft parking areas and terminal areas.
10-62	Taxiway	The portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.
10-63	Taxiway/Taxilane Safety Area (TSA)	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft. See the construction safety and phasing plan (CSPP) for limits of the TSA.
10-64	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.
10-65	Working day	A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.
10-66	Owner Defined terms	None.

END OF SECTION 10

Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders). The Owner has published the advertisement at such places and at such times as are required by local law or ordinances. The published advertisement states the time and place for submitting sealed proposals; a description of the proposed work; instructions to bidders as to obtaining proposal forms, plans, and specifications; proposal guaranty required; and the Owner's right to reject any and all bids.

20-02 Qualification of bidders. Each bidder shall submit evidence of competency and evidence of financial responsibility to perform the work to the Owner at the time of bid opening.

Evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, and a list of equipment and a list of key personnel that would be available for the work.

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

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

20-03 Contents of proposal forms. The Owner's proposal forms state the location and description of the proposed construction; the place, date, and time of opening of the proposals; and the estimated quantities of the various items of work to be performed and materials to be furnished for which unit bid prices are asked. The proposal form states the time in which the work must be completed, and the amount of the proposal guaranty that must accompany the proposal. The Owner will accept only those Proposals properly executed on physical forms or electronic forms provided by the Owner. Bidder actions that may cause the Owner to deem a proposal irregular are given in subsection 20-09, titled IRREGULAR PROPOSALS.

Mobilization is limited to 10 percent of the total project cost.

An in-person prebid conference will be conducted at the time and location indicated in the bidding documents. The conference will serve as an opportunity for the bidders walk the site ahead of bidding. Material requirements, submittal process, quality control/quality assurance requirements, the construction safety and phasing plan, airport access, allowable staging areas, and paving requirements unique to the airport will be discussed. Bidder attendance at the prebid conference is optional. Attendees of the project's prebid conference will be recorded onsite at the beginning of the site walk and distributed to members of the planholder's list.

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

- a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.
- b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.
- c. Documented record of Contractor default under previous contracts with the Owner.
- d. Documented record of unsatisfactory work on previous contracts with the Owner.

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

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

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

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

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

20-08 Responsive and responsible bidder. A responsive bid conforms to all significant terms and conditions contained in the Owner's invitation for bid. It is the Owner's responsibility to decide if the

exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 2 CFR § 200.318(h). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

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

- a. If the proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered, or if any part of the proposal form is detached.
- b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.
- c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.
- d. If the proposal contains unit prices that are obviously unbalanced.
- e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.
- f. If the applicable Disadvantaged Business Enterprise information is incomplete.

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

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

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

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

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

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

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

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

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

20-15 Discrepancies and Omissions. A Bidder who discovers discrepancies or omissions with the project bid documents shall immediately notify the Owner’s Engineer of the matter. A bidder that has doubt as to the true meaning of a project requirement may submit to the Owner’s Engineer a written request for interpretation no later than 10 days prior to bid opening.

Any interpretation of the project bid documents by the Owner’s Engineer will be by written addendum issued by the Owner. The Owner will not consider any instructions, clarifications or interpretations of the bidding documents in any manner other than written addendum.

END OF SECTION 20

Section 30 Award and Execution of Contract

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

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

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

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

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

30-02 Award of contract. The award of a contract, if it is to be awarded, shall be made within 90 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

If the Owner elects to proceed with an award of contract, the Owner will make award to the responsible bidder whose bid, conforming with all the material terms and conditions of the bid documents, is the lowest in price.

No award shall be made until the FAA has concurred in the Owner's recommendation to make such award and has approved the Owner's proposed contract, to the extent that such concurrence and approval are required by 2 CFR 200.324.

There is no guarantee that any or all of the bid alternates will be selected for construction as part of this project. Project bid alternates will be constructed based on federal grant availability. In the event that a funding source is available for the construction of bid alternates the Owner will select a low bid based on the total cost of the base bid and any bid alternates in which the total cost can be surmounted with the assistance of federal funding. Bid alternates will not be constructed without the base bid schedule. Project funding will be applied first to the base bid and then to subsequent bid alternates in level of importance to the project's owner.

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

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

be returned as soon as the Owner receives the contract bonds as specified in subsection 30-05, titled REQUIREMENTS OF CONTRACT BONDS of this section.

30-05 Requirements of contract bonds. At the time of the execution of the contract, the successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor's performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

30-06 Execution of contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety bond or bonds specified in subsection 30-05, titled REQUIREMENTS OF CONTRACT BONDS of this section, within **15** calendar days from the date mailed or otherwise delivered to the successful bidder.

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

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

END OF SECTION 30

Section 40 Scope of Work

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

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

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

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

It is mutually agreed that the submission of a proposal shall be considered prima facie evidence that the bidder has made such examination and is familiar with the character, quality and quantity of the work to be performed and material to be furnished. After the submission of the proposal, no complaint or claim that there was any misunderstanding as to the quantities, conditions or nature of the work will be entertained. The Contractor shall be liable to the Owner for any damage resulting from any errors or deficiencies in the Contract Documents or instructions furnished by the Owner or its Agent if said errors or deficiencies were or could have been discoverable by reasonable inspection prior to the commencement of construction.

40-02 Alteration of work and quantities. The Owner reserves the right to make such changes in quantities and work as may be necessary or desirable to complete, in a satisfactory manner, the original intended work. Unless otherwise specified in the Contract, the Owner's Engineer or RPR shall be and is hereby authorized to make, in writing, such in-scope alterations in the work and variation of quantities as may be necessary to complete the work, provided such action does not represent a significant change in the character of the work.

For purpose of this section, a significant change in character of work means: any change that is outside the current contract scope of work; any change (increase or decrease) in the total contract cost by more than 25%; or any change in the total cost of a major contract item by more than 25%.

Work alterations and quantity variances that do not meet the definition of significant change in character of work shall not invalidate the contract nor release the surety. Contractor agrees to accept payment for such work alterations and quantity variances in accordance with Section 90, subsection 90-03, titled COMPENSATION FOR ALTERED QUANTITIES.

Should the value of altered work or quantity variance meet the criteria for significant change in character of work, such altered work and quantity variance shall be covered by a supplemental agreement. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds. 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 be approved by the FAA and shall include valid wage determination of the U.S. Secretary of Labor.

40-03 Omitted items. The Owner, the Owner's Engineer or the RPR may provide written notice to the Contractor to omit from the work any contract item that does not meet the definition of major contract item. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

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

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, Owner may issue a Change Order to cover the necessary extra work. Change orders for 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 RPR's opinion, is necessary for completion of the extra work.

When determined by the RPR to be in the Owner's best interest, the RPR may order the Contractor to proceed with extra work as provided in subsection 90-05, titled PAYMENT FOR EXTRA WORK of Section 90. Extra work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a supplemental agreement as defined in subsection 10-59, titled SUPPLEMENTAL AGREEMENT of Section 10.

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

40-05 Maintenance of traffic. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. The Contractor shall maintain traffic in the manner detailed in the Construction Safety and Phasing Plan (CSPP).

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

b. With respect to their own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport in accordance with the construction safety and phasing plan (CSPP) and the safety plan compliance document (SPCD).

c. When the contract requires the maintenance of 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 the road, street, or highway open to all traffic and shall provide maintenance as may be required to accommodate traffic. The Contractor, at their expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's

equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (<http://mutcd.fhwa.dot.gov/>), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

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

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

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

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

- a. Use such material in another contract item, providing such use is approved by the RPR 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 RPR; or
- c. Use such material for the Contractor's own temporary construction on site; or,
- d. Use such material as intended by the terms of the contract.

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

Should the RPR 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 their expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the RPR 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 their own exercise of option a., b., or c.

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

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

40-09 Contractor Key Personnel. The Contractor shall employ a competent Superintendent(s) and necessary assistants who shall be in attendance at the Project site during the progress of the work. The Superintendent(s) shall be satisfactory to the Owner, and shall not be changed except with the written consent of the Owner. The Contractor shall identify the key personnel he intends to assign to the Project prior to execution of the Contract.

Any person employed by the Contractor or any Subcontractor who, in the opinion of the Engineer or RPR, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer or RPR, be removed from the work by the Contractor or Subcontractor employing such person, and shall not be employed again in any portion of the work without the written approval of the Engineer. The Contractor or Subcontractor shall keep the Owner and Engineer harmless from damages or claims for compensation that may occur in the enforcement of this Section.

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

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

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

END OF SECTION 40

Section 50 Control of Work

50-01 Authority of the Resident Project Representative (RPR). The RPR has final authority regarding the interpretation of project specification requirements. The RPR shall determine acceptability of the quality of materials furnished, method of performance of work performed, and the manner and rate of performance of the work. The RPR does not have the authority to accept work that does not conform to specification requirements.

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

If the RPR 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 their opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the RPR will advise the Owner of their determination that the affected work be accepted and remain in place. The RPR will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. Changes in the contract price must be covered by contract change order or supplemental agreement as applicable.

If the RPR 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 RPR's written orders.

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 RPR's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the RPR's opinion, such compliance is essential to provide an acceptable finished portion of the work.

The term "reasonably close conformity" is also intended to provide the RPR with the authority, after consultation with the Sponsor and FAA, to use sound engineering judgment in their determinations to accept work that is not in strict conformity, but will provide a finished product equal to or better than that required by the requirements of the contract, plans and specifications.

The RPR 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. If electronic files are provided and used on the project and there is a conflict between the electronic files and hard copy plans, the hard copy plans shall govern. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If

any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the RPR for an 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, Contractor shall immediately notify the Owner or the designated representative in writing requesting their written interpretation and decision.

50-04 List of Special Provisions. No special provisions require their own additional subsections in this document. Special provisions have been incorporated into existing specification subsections.

50-05 Cooperation of Contractor. The Contractor shall be supplied with an electronic PDF of the plans and specifications. The Contractor shall have available on the construction site at all times one hardcopy each of the plans and specifications. Additional hard copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the RPR and their 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 their 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 RPR or their authorized representative.

50-06 Cooperation between Contractors. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work 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 their own contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

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

50-07 Construction layout and stakes. The Engineer/RPR shall establish necessary horizontal and vertical control. The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor. Contractor is responsible for preserving integrity of horizontal and vertical controls established by Engineer/RPR. In case of negligence on the part of the Contractor or their employees, resulting in the destruction of any horizontal and vertical control, the resulting costs will be deducted as a liquidated damage against the Contractor.

Prior to the start of construction, the Contractor will check all control points for horizontal and vertical accuracy and certify in writing to the RPR that the Contractor concurs with survey control established for the project. All lines, grades and measurements from control points necessary for the proper execution and control of the work on this project will be provided to the RPR. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the RPR for each area of construction and for each placement of material as specified to allow the RPR to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the RPR prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in digital format.

Laser, GPS, String line, or other automatic control shall be checked with temporary control as necessary. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.

No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses. The cost shall be included in the price of the bid for the various items of the Contract.

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

QA Inspectors are authorized to notify the Contractor or their 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 RPR for a decision.

50-09 Inspection of the work. All materials and each part or detail of the work shall be subject to inspection. The RPR 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 RPR 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.

Provide advance written notice to the RPR of work the Contractor plans to perform each week and each day. Any work done or materials used without written notice and allowing opportunity for inspection by the RPR may be ordered removed and replaced at the Contractor's expense.

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 RPR as provided in subsection 50-02, titled CONFORMITY WITH PLANS AND SPECIFICATIONS, in 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 subsection 70-14, titled CONTRACTOR'S RESPONSIBILITY FOR WORK in section 70.

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

Upon failure on the part of the Contractor to comply with any order of the RPR made under the provisions of this subsection, the RPR will have authority to cause unacceptable work to be remedied or removed and replaced; and unauthorized work to be removed and recover the resulting costs as a liquidated damage against 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, at their own expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel.

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

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

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

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in subsection 50-12, titled MAINTENANCE DURING CONSTRUCTION, the RPR 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 RPR'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 recovered as a liquidated damage against the Contractor.

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

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

inspection shall constitute the final inspection. The RPR 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 RPR will notify the Contractor and the Contractor shall correct the unsatisfactory work. 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 RPR 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 for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the RPR in writing of their intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the RPR 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 RPR has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the RPR 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 Retest of Work. When, as provided for in the Contract Documents, the Owner or Contractor performs sampling and tests of the work and the tests show a failure to meet the requirements of the Contract Documents, the expense of re-testing, after re-working substitution by the Contractor, will be at the expense of Contractor, and such costs will be paid directly to the Owner, or Construction Manager.

50-18 Correction of Work After Final Payment. Neither the final certificate for payment, nor any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty materials or workmanship and, unless otherwise specified, he shall remedy any defect due thereto and pay for any damage to other work resulting therefrom, which shall appear within a period of one (1) year from date of Final Acceptance.

The Owner shall give notice of observed defects with reasonable promptness. Wherever the word "acceptance" occurs, it shall be understood to mean Final Acceptance.

END OF SECTION 50

Section 60 Control of Materials

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

In order to expedite the inspection and testing of materials, the Contractor shall furnish documentation to the RPR as to the origin, composition, and manufacture of all materials to be used in the work.

Documentation shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the RPR's option, materials may be approved at the source of supply before delivery. 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 meets the requirements of the specifications; and is listed in AC 150/5345-53, *Airport Lighting Equipment Certification Program and Addendum*, that is in effect on the date of advertisement.

60-02 Samples, tests, and cited specifications. All materials used in the work shall be inspected, tested, and approved by the RPR before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the RPR 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 RPR, shall be removed at the Contractor's expense.

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

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the RPR. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the RPR.

A copy of all Contractor QC test data shall be provided to the RPR 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 RPR showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

The Contractor shall employ a Quality Control (QC) testing organization to perform all Contractor required QC tests in accordance with *Item C-100 Contractor Quality Control Program (CQCP)*.

60-03 Certification of compliance/analysis (COC/COA). The RPR may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's COC 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. The COA is the manufacturer's COC and includes all applicable test results.

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 RPR.

When a material or assembly is specified by “brand name or equal” and the Contractor elects to furnish the specified “or equal,” 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.

The RPR shall be the sole judge as to whether the proposed “or equal” is suitable for use in the work.

The RPR reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

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

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

- a. The RPR shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.
- b. The RPR 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 RPR, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Place office or working space in a convenient location 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 RPR 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/ Resident Project Representative (RPR) field office. An Engineer/RPR field office is not required.

60-06 Storage of materials. Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the RPR. 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 and/or CSPP, the storage of materials and the location of the Contractor’s plant and parked equipment or vehicles shall be as directed by the RPR. 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 RPR 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 their 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 RPR.

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 RPR has approved its use in the work.

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

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

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

END OF SECTION 60

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Section 70 Legal Regulations and Responsibility to Public

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

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

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

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

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

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

70-05 Federal Participation. The United States Government has agreed to reimburse the Owner for some portion of the contract costs. The contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator. No requirement of this contract shall be construed as making the United States a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-06 Sanitary, health, and safety provisions. The Contractor's worksite and facilities shall comply with applicable federal, state, and local requirements for health, safety and sanitary provisions.

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

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

The Contractor shall remove or control debris and rubbish resulting from its work operations at frequent intervals, and upon the order of the RPR. If the RPR determines the existence of Contractor debris in the work site represents a hazard to airport operations and the Contractor is unable to respond in a prompt and reasonable manner, the RPR reserves the right to assign the task of debris removal to a third party and recover the resulting costs as a liquidated damage against the Contractor.

70-08 Construction Safety and Phasing Plan (CSPP). The Contractor shall complete the work in accordance with the approved Construction Safety and Phasing Plan (CSPP) developed in accordance with AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP is within the project plans.

70-09 Use of explosives. The use of explosives is not permitted on this project.

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

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

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

70-11 Responsibility for damage claims. The Contractor shall indemnify and hold harmless the Engineer/RPR and the Owner and their officers, agents, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of their own contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, their own surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the

Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

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

70-13 Opening sections of the work to traffic. If it is necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such “phasing” of the work must be specified below and indicated on the approved Construction Safety and Phasing Plan (CSPP) and the project plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified.

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

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

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

The Contractor must conform to safety standards contained AC 150/5370-2 and the approved CSPP.

Contractor shall refer to the plans, specifications, and the approved CSPP to identify barricade requirements, temporary and/or permanent markings, airfield lighting, guidance signs and other safety requirements prior to opening up sections of work to traffic.

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

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

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

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

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

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of their plan of operations. Such notification shall be in writing addressed to "The Person to Contact" as provided in this paragraph and subsection 70-04, titled RESTORATION OF SURFACES DISTURBED BY OTHERS. A copy of each notification shall be given to the RPR.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

70-19 Environmental protection. The Contractor shall comply with all federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, asphalts, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

70-20 Archaeological and historical findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

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

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

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Section 80 Execution and Progress

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

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

Should the Contractor elect to assign their 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.

The Contractor shall provide copies of all subcontracts to the RPR 14 days prior to being utilized 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.

80-02 Notice to proceed (NTP). The Owners notice to proceed will state the date on which contract time commences. The Contractor is expected to commence project operations within 3 days of the NTP date. The Contractor shall notify the RPR at least 24 hours in advance of the time contract operations begins. The Contractor shall not commence any actual operations prior to the date on which the notice to proceed is issued by the Owner.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their coordinated construction schedule showing all work activities for the RPR's review and acceptance at least 10 days prior to the start of work. The Contractor's progress schedule, once accepted by the RPR, will represent the Contractor's baseline plan to accomplish the project in accordance with the terms and conditions of the Contract. The RPR will compare actual Contractor progress against the baseline schedule to determine that status of the Contractor's performance. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

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

The Contractor shall not commence any actual construction prior to the date on which the NTP is issued by the Owner.

The project schedule shall be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or other format, or as otherwise specified. It shall include information on the sequence of work activities, milestone dates, and activity duration. The schedule shall show all work items identified in the project proposal for each work area and shall include the project start date and end date.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

80-04 Limitation of operations. The Contractor shall control their operations and the operations of their subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct their operations within an AOA of the airport, the work shall be coordinated with airport operations (through the RPR) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the RPR and until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, subsection 70-08, titled CONSTRUCTION SAFETY AND PHASING PLAN (CSPP).

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; and 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 satisfactory conditions are provided. The areas of the AOA identified in the Construction Safety Phasing Plan (CSPP) and as listed below, 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 shown on the CSPP.

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

80-04.1 Operational safety on airport during construction. All Contractors' operations shall be conducted in accordance with the approved project Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD) and the provisions set forth within the current version of AC 150/5370-2, Operational Safety on Airports During Construction. 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 SPCD that details how it proposes to comply with the requirements presented within the CSPP.

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

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and SPCD and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP and SPCD unless approved in writing by the Owner. The necessary coordination actions to review Contractor proposed modifications to an approved CSPP or approved SPCD can require a significant amount of time.

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

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

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

Should the Contractor fail to remove such person or persons, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the RPR 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 not cause injury to previously completed work, adjacent property, or existing airport facilities due to 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 otherwise authorized by the RPR. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the RPR 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 RPR 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 RPR 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 paragraph.

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 the Owner may deem necessary, due to unsuitable weather, or other conditions considered unfavorable for the execution of the work, or for such time 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 written order to suspend work to the effective date of the written order to resume the work. Claims for such compensation shall be filed with the RPR within the time period stated in the RPR's order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The RPR 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 or for any other delay provided for in the contract, plans, or specifications.

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

80-07 Determination and extension of contract time. The number of calendar days shall be stated in the proposal and contract and shall be known as the Contract Time.

If the contract time requires extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

80-07.1 Contract time based on calendar days. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

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

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

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

- a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or
- b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or
- c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- d. Discontinues the execution of the work, or
- e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or
- f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or
- h. Makes an assignment for the benefit of creditors, or

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

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

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

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

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

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

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

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

Termination of the contract or a portion thereof shall neither relieve the Contractor of their responsibilities for the completed work nor shall it relieve their 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 RPR 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 work in accordance with the approved CSPP and SPCD.

END OF SECTION 80

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Section 90 Measurement and Payment

90-01 Measurement of quantities. All work completed under the contract will be measured by the RPR, or their authorized representatives, using United States Customary Units of Measurement.

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

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

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

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

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

Measurement and Payment Terms

Term	Description
Excavation and Embankment Volume	In computing volumes of excavation, the average end area method will be used unless otherwise specified.
Measurement and Proportion by Weight	The term “ton” will mean the short ton consisting of 2,000 pounds (907 kg) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, independently certified scales by competent, qualified personnel at locations designated by the RPR. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the RPR directs, and each truck shall bear a plainly legible identification mark.
Measurement by Volume	Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this

Term	Description
	purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.
Asphalt Material	Asphalt materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, will be used for computing quantities.
Cement	Cement will be measured by the ton (kg) or hundredweight (km).
Structure	Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.
Timber	Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.
Plates and Sheets	The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.
Miscellaneous Items	When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.
Scales	Scales must be tested for accuracy and serviced before use. 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. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end. Scales shall be accurate within 0.5% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the RPR 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 0.1% of the nominal rated capacity of the scale, but not less than one pound (454 grams). The use of spring balances will not be permitted.

Term	Description
	In the event inspection reveals the scales have been “overweighing” (indicating more than correct weight) they will be immediately adjusted. All materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of 0.5%. In the event inspection reveals the scales have been under-weighing (indicating less than correct weight), they shall be immediately adjusted. No additional payment to the Contractor will be allowed for materials previously weighed and recorded. Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the RPR 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. 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.
Rental Equipment	Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered in connection with extra work will be measured as agreed in the change order or supplemental agreement authorizing such work as provided in subsection 90-05 <i>Payment for Extra Work</i>.
Pay Quantities	When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the RPR. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

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

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

90-03 Compensation for altered quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in Section 40, subsection 40-02, titled

ALTERATION OF WORK AND QUANTITIES, will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from their own unbalanced allocation of overhead and profit among the contract items, or from any other cause.

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

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

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

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

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

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

From the total of the amount determined to be payable on a partial payment, 5% percent of such total amount will be deducted and retained by the Owner for protection of the Owner's interests. Unless otherwise instructed by the Owner, the amount retained by the Owner will be in effect until the final payment is made except as follows:

- (1) Contractor may request release of retainage on work that has been partially accepted by the Owner in accordance with subsection 50-14. Contractor must provide a certified invoice to the RPR that supports the value of retainage held by the Owner for partially accepted work.
- (2) In lieu of retainage, the Contractor may exercise at its option the establishment of an escrow account per subsection 90-08.

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

When at least 95% of the work has been completed to the satisfaction of the RPR, the RPR shall, at the Owner's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done. The Owner may retain an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

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

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

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

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

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

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

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

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

e. The Contractor has furnished the Owner evidence that the material stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of their responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

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

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

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

90-08 Payment of withheld funds. At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in subsection 90-06 titled PARTIAL PAYMENTS, the Contractor

may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

- a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.
- b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.
- c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.
- d. The Contractor shall obtain the written consent of the surety to such agreement.

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

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

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

90-10 Construction warranty.

- a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.
- b. This warranty shall continue for a period of one year from the date of final acceptance of the work, except as noted. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work. Light Emitting Diode emitting diode (LED) light fixtures with the exception of obstruction lighting, must be warranted by the manufacturer for a minimum of four (4) years after date of installation inclusive of all electronics.
- c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Owner real or personal

property, when that damage is the result of the Contractor's failure to conform to contract requirements; or any defect of equipment, material, workmanship, or design furnished by the Contractor.

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

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

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

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

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

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

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

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

c. Complete final cleanup in accordance with Section 40, subsection 40-08, *Final Cleanup*.

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

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

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

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

h. Manufacturer's certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.

j. Project Operation and Maintenance (O&M) Manual(s).

k. Security for Construction Warranty.

l. Equipment commissioning documentation submitted, if required.

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

END OF SECTION 90

Part 2 – General Construction Items

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 20 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 subsections 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 subsection 100-6.
- (2) Performance of all QC tests as required by the technical specifications and subsection 100-8.
- (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, subsection 80-03, titled 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 subsection 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 subsection 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-100-1 Contractor Quality Control Program (CQCP) – 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

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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.

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 Grass. Grass that will not compete with the grasses sown later for permanent cover per Item T-901 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

102-2.2 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

102-2.3 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

102-2.4 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

102-2.5 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.

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.

102-3.5 Stormwater Pollution Prevention Plan Requirements. Water pollution control work shall conform to the provisions in this section. Prior to commencing any working on the Airport, the contractor shall prepare and submit to the Engineer for approval a Storm Water Pollution Prevention Plan (SWPPP).

The Contractor may obtain other National Pollutant Discharge Elimination System (NPDES) permits that apply to activities and mobile operations within or outside of the project limits including hot mix asphalt batch plants, material borrow areas, concrete plants, staging areas, storage yards, or access roads.

The Contractor shall perform water pollution control work in conformance with the requirements in the "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" and its addenda in effect on the day the Notice to Contractors is dated. This manual is referred to as the "Preparation Manual." Copies of the Preparation Manual may be obtained from:

State of California
Department of Transportation
Publication Distribution Unit
1900 Royal Oaks Drive
Sacramento, California 95815
Telephone: (916) 445-3520

The Preparation Manual and other references for performing water pollution control work are available from the State's Construction Storm Water and Water Pollution Control web site at:

<http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm>

Before the start of job site activities, the Contractor shall provide training for project managers, supervisory personnel, and employees involved with water pollution control work. The training shall include:

- A. Rules and regulations
- B. Implementation and maintenance for:
 - 1. Temporary Soil Stabilization
 - 2. Temporary Sediment Control
 - 3. Tracking Control
 - 4. Wind Erosion Control

The Contractor shall designate in writing a Water Pollution Control Manager (WPCM). The Contractor shall submit a statement of qualifications describing the training, work history, and expertise of the proposed WPCM. The qualifications must include:

- A. Qualified SWPP Practitioner Certification

The WPCM shall be:

- A. Responsible for water pollution control work.
- B. The primary contact for water pollution control work.
- C. Have authority to mobilize crews to make immediate repairs to water pollution control practices.

The Contractor may designate one manager to prepare the SWPPP and a different manager to implement the plan. The SWPPP preparer shall meet the training requirements for the WPCM.

STORM WATER POLLUTION PREVENTION PLAN

The Contractor shall submit a Storm Water Pollution Prevention Plan (SWPPP) to the Engineer for approval. The SWPPP shall conform to the requirements in the WPCP Preparation Manual, the NPDES Regional and General permits, and these special provisions.

The SWPPP shall include water pollution control practices:

- A. For storm water and non-storm water from areas outside of the job site related to construction activities for this contract such as:
 - 1. Staging areas.
 - 2. Storage yards.
 - 3. Access roads.
- B. Appropriate for each season as described in "Implementation Requirements" of this Item.
- C. For activities or mobile operations related to all NPDES permits.

The Contractor shall develop a Water Pollution Control Schedule that describes the timing of grading or other work activities that could affect water pollution. The Water Pollution Control Schedule shall be updated by the Contractor to reflect changes in the Contractor's operations that would affect the necessary implementation of water pollution control practices.

One hundred percent (100%) of exposed disturbed areas, including all flat areas and slopes, shall have erosion protection BMPs properly installed and maintained year-round.

The SWPPP shall include a schedule that:

- A. Describes when work activities that could cause water pollution will be performed.
- B. Identifies soil stabilization and sediment control practices for disturbed soil area.
- C. Includes dates when these practices will be 25, 50, and 100 percent complete.
- D. Shows 100 percent completion of these practices before the rainy season.

The SWPPP shall include the following temporary water pollution control practices and their associated items of work as required to complete the project as shown on the plans and specified.

- A. Temporary Soil Stabilization
- B. Temporary Sediment Control
- C. Tracking Control
- D. Wind Erosion Control
- E. Non-Storm Water Management
- F. Waste Management and Materials Pollution Control

Within 5 working days after the date the Notice to Proceed is issued, the Contractor shall submit 5 copies of the SWPPP to the Engineer.

The Contractor shall not perform work that may cause water pollution until the SWPPP has been approved by the Engineer, a WDID is issued by the State Water Resource Control Board in response to a Notice of Intent (NOI). The Engineer's review and approval shall not waive any contract requirements and shall not relieve the Contractor from complying with Federal, State and local laws, regulations, and requirements.

If there is a change in construction schedule or activities, the Contractor shall prepare an amendment to the SWPPP to identify additional or revised water pollution control practices. The Contractor shall submit the amendment to the Engineer for review within a time agreed to by the Engineer not to exceed the number of days specified for the initial submittal of the SWPPP. The Engineer will review the amendment within the same time allotted for the review of the initial submittal of the SWPPP.

If directed by the Engineer or requested in writing by the Contractor and approved by the Engineer, changes to the water pollution control work specified in these special provisions will be allowed.

Changes may include addition of new water pollution control practices. The Contractor shall incorporate these changes in the SWPPP.

The Contractor shall keep a copy of the approved SWPPP and approved amendments at the job site. The SWPPP and approved amendments shall be made available when requested by a representative of the Regional Water Quality Control Board, State Water Resources Control Board, United States Environmental Protection Agency, or the local storm water management agency. Requests from the public shall be directed to the Engineer.

METHOD OF MEASUREMENT

102-4.1 Temporary erosion and pollution control work required will be performed as scheduled or directed by the RPR. Completed and accepted work will be measured as follows:

- a. Temporary air and water pollution, soil erosion and siltation control, SWPPP Preparation and implementation, fiber rolls, silt fence, gravel bags, concrete washouts, stabilized construction entrances, inlet protection and other BMPs shall be measured as a lump sum. A detailed list of each item installed and maintained shall be prepared and provided by the contractor if requested.

102-4.2 Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor.

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 subsection 102-4.1 will be paid for under:

Item C-102-1 Temporary Erosion and Pollution 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, subsection 90-05, titled 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 7 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. An Engineer/RPR field office is not required.

METHOD OF MEASUREMENT

105-5 Basis of measurement and payment. 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, subsection 90-11, titled CONTRACTOR FINAL PROJECT DOCUMENTATION, the final 10%.

BASIS OF PAYMENT

105-6 Payment will be made under:

Item C-105-1 Mobilization (7%) – 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 C-110 Method of Estimating Percentage of Material Within Specification Limits (PWL)

110-1 General. When the specifications provide for acceptance of material based on the method of estimating percentage of material within specification limits (PWL), the PWL will be determined in accordance with this section. All test results for a lot will be analyzed statistically to determine the total estimated percent of the lot that is within specification limits. The PWL is computed using the sample average ($\bar{X}$) and sample standard deviation (S_n) of the specified number (n) of sublots for the lot and the specification tolerance limits, L for lower and U for upper, for the particular acceptance parameter. From these values, the respective Quality index, Q_L for Lower Quality Index and/or Q_U for Upper Quality Index, is computed and the PWL for the lot for the specified n is determined from Table 1. All specification limits specified in the technical sections shall be absolute values. Test results used in the calculations shall be to the significant figure given in the test procedure.

There is some degree of uncertainty (risk) in the measurement for acceptance because only a small fraction of production material (the population) is sampled and tested. This uncertainty exists because all portions of the production material have the same probability to be randomly sampled. The Contractor's risk is the probability that material produced at the acceptable quality level is rejected or subjected to a pay adjustment. The Owner's risk is the probability that material produced at the rejectable quality level is accepted.

It is the intent of this section to inform the Contractor that, in order to consistently offset the Contractor's risk for material evaluated, production quality (using population average and population standard deviation) must be maintained at the acceptable quality specified or higher. In all cases, it is the responsibility of the Contractor to produce at quality levels that will meet the specified acceptance criteria when sampled and tested at the frequencies specified.

110-2 Method for computing PWL. The computational sequence for computing PWL is as follows:

- a. Divide the lot into n sublots in accordance with the acceptance requirements of the specification.
- b. Locate the random sampling position within the subplot in accordance with the requirements of the specification.
- c. Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.
- d. Find the sample average ($\bar{X}$) for all subplot test values within the lot by using the following formula:

$$\bar{X} = (x_1 + x_2 + x_3 + \dots + x_n) / n$$

Where: $\bar{X}$ = Sample average of all subplot test values within a lot

$x_1, x_2, \dots, x_n$ = Individual subplot test values

n = Number of subplot test values

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

$$S_n = [(d_1^2 + d_2^2 + d_3^2 + \dots + d_n^2)/(n-1)]^{1/2}$$

Where: S_n = Sample standard deviation of the number of subplot test values in the set

$d_1, d_2, \dots, d_n$ = Deviations of the individual subplot test values $x_1, x_2, \dots$ from the average value $\bar{X}$

that is: $d_1 = (x_1 - \bar{X}), d_2 = (x_2 - \bar{X}) \dots d_n = (x_n - \bar{X})$

n = Number of subplot test values

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

$$Q_L = (\bar{X} - L) / S_n$$

Where: L = specification lower tolerance limit

Estimate the percentage of material within limits (PWL) by entering Table 1 with Q_L , using the column appropriate to the total number (n) of measurements. If the value of Q_L falls between values shown on the table, use the next higher value of PWL.

g. For double-sided specification limits (i.e., L and U), compute the Quality Indexes Q_L and Q_U by use of the following formulas:

$$Q_L = (\bar{X} - L) / S_n$$

and

$$Q_U = (U - \bar{X}) / S_n$$

Where: L and U = specification lower and upper tolerance limits

Estimate the percentage of material between the lower (L) and upper (U) tolerance limits (PWL) by entering Table 1 separately with Q_L and Q_U , using the column appropriate to the total number (n) of measurements, and determining the percent of material above P_L and percent of material below P_U for each tolerance limit. If the values of Q_L fall between values shown on the table, use the next higher value of P_L or P_U . Determine the PWL by use of the following formula:

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

Where: P_L = percent within lower specification limit

P_U = percent within upper specification limit

EXAMPLE OF PWL CALCULATION

Project: Example Project

Test Item: Item P-401, Lot A.

A. PWL Determination for Mat Density.

1. Density of four random cores taken from Lot A.

A-1 = 96.60

A-2 = 97.55

A-3 = 99.30

A-4 = 98.35

$n = 4$

2. Calculate average density for the lot.

$$X = (x_1 + x_2 + x_3 + \dots + x_n) / n$$

$$X = (96.60 + 97.55 + 99.30 + 98.35) / 4$$

$$X = 97.95\% \text{ density}$$

3. Calculate the standard deviation for the lot.

$$S_n = [((96.60 - 97.95)^2 + (97.55 - 97.95)^2 + (99.30 - 97.95)^2 + (98.35 - 97.95)^2) / (4 - 1)]^{1/2}$$

$$S_n = [(1.82 + 0.16 + 1.82 + 0.16) / 3]^{1/2}$$

$$S_n = 1.15$$

4. Calculate the Lower Quality Index Q_L for the lot. ($L=96.3$)

$$Q_L = (X - L) / S_n$$

$$Q_L = (97.95 - 96.30) / 1.15$$

$$Q_L = 1.4348$$

5. Determine PWL by entering Table 1 with $Q_L = 1.44$ and $n = 4$.

$$PWL = 98$$

B. PWL Determination for Air Voids.

1. Air Voids of four random samples taken from Lot A.

$$A-1 = 5.00$$

$$A-2 = 3.74$$

$$A-3 = 2.30$$

$$A-4 = 3.25$$

2. Calculate the average air voids for the lot.

$$X = (x_1 + x_2 + x_3 + \dots + x_n) / n$$

$$X = (5.00 + 3.74 + 2.30 + 3.25) / 4$$

$$X = 3.57\%$$

3. Calculate the standard deviation S_n for the lot.

$$S_n = [((3.57 - 5.00)^2 + (3.57 - 3.74)^2 + (3.57 - 2.30)^2 + (3.57 - 3.25)^2) / (4 - 1)]^{1/2}$$

$$S_n = [(2.04 + 0.03 + 1.62 + 0.10) / 3]^{1/2}$$

$$S_n = 1.12$$

4. Calculate the Lower Quality Index Q_L for the lot. ($L = 2.0$)

$$Q_L = (X - L) / S_n$$

$$Q_L = (3.57 - 2.00) / 1.12$$

$$Q_L = 1.3992$$

5. Determine P_L by entering Table 1 with $Q_L = 1.41$ and $n = 4$.

$$P_L = 97$$

6. Calculate the Upper Quality Index Q_U for the lot. ($U = 5.0$)

$$Q_U = (U - X) / S_n$$

$$Q_U = (5.00 - 3.57) / 1.12$$

$$Q_U = 1.2702$$

7. Determine P_U by entering Table 1 with $Q_U = 1.29$ and $n = 4$.

$$P_U = 93$$

8. Calculate Air Voids PWL

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

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

EXAMPLE OF OUTLIER CALCULATION (REFERENCE ASTM E178)

Project: Example Project

Test Item: Item P-401, Lot A.

A. Outlier Determination for Mat Density.

1. Density of four random cores taken from Lot A arranged in descending order.

$$A-3 = 99.30$$

$$A-4 = 98.35$$

$$A-2 = 97.55$$

$$A-1 = 96.60$$

2. From ASTM E178, Table 1, for $n=4$ an upper 5% significance level, the critical value for test criterion = 1.463.

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

a. For measurements greater than the average:

If (measurement - average)/(standard deviation) is less than test criterion, then the measurement is not considered an outlier.

For A-3, check if $(99.30 - 97.95) / 1.15$ is greater than 1.463.

Since 1.174 is less than 1.463, the value is not an outlier.

b. For measurements less than the average:

If (average - measurement)/(standard deviation) is less than test criterion, then the measurement is not considered an outlier.

For A-1, check if $(97.95 - 96.60) / 1.15$ is greater than 1.463.

Since 1.135 is less than 1.463, the value is not an outlier.

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

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

OR

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

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

Percent Within Limits (P_L and P_U)	Positive Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420

Percent Within Limits (P _L and P _U)	Positive Values of Q (Q _L and Q _U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4717	1.4829	1.4914
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653
87	1.0597	1.1100	1.1173	1.1192	1.1199	1.1204	1.1208	1.1212
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990
83	0.9939	0.9900	0.9785	0.9715	0.9671	0.9643	0.9624	0.9610
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686
70	0.6787	0.6000	0.5719	0.5582	0.5504	0.5454	0.5419	0.5394
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537
66	0.5563	0.4800	0.4545	0.4424	0.4355	0.4310	0.4280	0.4257
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4030	0.4001	0.3980
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2093
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566
55	0.1806	0.1500	0.1406	0.1363	0.1338	0.1322	0.1312	0.1304
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1049	0.1042
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0793	0.0786	0.0781
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260
50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Percent Within Limits (P _L and P _U)	Negative Values of Q (Q _L and Q _U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304
44	-0.2164	-0.1800	-0.1688	-0.1636	-0.1607	-0.1588	-0.1575	-0.1566
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829

Percent Within Limits (P _L and P _U)	Negative Values of Q (Q _L and Q _U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4355	-0.4310	-0.4280	-0.4257
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105
30	-0.6787	-0.6000	-0.5719	-0.5582	-0.5504	-0.5454	-0.5419	-0.5394
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282
26	-0.7904	-0.7200	-0.6921	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8245	-0.8214	-0.8192
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789
13	-1.0597	-1.1100	-1.1113	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4717	-1.4829	-1.4914
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5871	-1.6127	-1.6313	-1.6454
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6993	-1.7235	-1.7420
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8053	-1.8379	-1.8630
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362

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.

ASTM International (ASTM)

ASTM E178 Standard Practice for Dealing with Outlying Observations

END OF ITEM C-110

Part 3 – Sitework

Item P-101 Surface Preparation

DESCRIPTION

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

EQUIPMENT AND MATERIALS

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

CONSTRUCTION

101-3.1 Removal of existing pavement.

The Contractor's removal operation shall be controlled to not damage adjacent pavement structure, and base material, cables, utility ducts, pipelines, or drainage structures which are to remain under the pavement.

Contractor shall refer to the Geotechnical Investigation for known pavement types, thicknesses, and locations. Contractor shall be aware that actual pavement types, thicknesses, and locations may vary those shown in the geotechnical investigation and the plans. There will be no additional compensation for additional pavement removal in excess of that which is shown on the plans or in the Geotechnical Investigation.

The Contractor is advised that there are numerous existing tie-down anchors, grounding rods and fence posts sleeves located within the existing pavement. These items consist of concrete and steel and some of them may be buried and not be visible on the surface. All of these items shall be removed as a part of the pavement demolition; there shall be no separate measurement or payment for the removal of these items and they shall be considered incidental to the pavement removal.

a. Concrete Pavement Removal. This section not used.

b. Pulverize Asphalt Pavement. Asphalt concrete pavement to be pulverized shall be sawcut to the full depth of the bituminous material around the perimeter of the area to be removed and as shown on the Plans. All asphalt pavement and aggregate base shall be removed by pulverization; no other removal method will be accepted unless otherwise noted on the plans. The Contractor shall pulverize existing asphalt and base to a minimum depth of 10 inches from the top of the existing asphalt surface or full depth of existing asphalt, whichever is greater. The Contractor shall locate and protect existing utility conduits prior to pulverization. The resulting pulverized material shall be: 1) processed, screened, and re-used in the production of P-207 used as Recycled Aggregate Base provided it meets the P-207 specification criteria; 2) hauled, spread and compacted to a minimum of 3" depth on the unpaved areas as shown on the Plans as Infield Surface Rock or as directed by the RPR. All excess pulverized material not used on the airfield shall be hauled to the disposal site location as shown on the plans with no additional cost to the Owner. Payment for processing and mixing the material shall be per section P-207.

c. Asphalt pavement removal. Asphalt pavement not designated for pulverization shall be cold milled. Asphalt pavement to be removed shall be cut to the full depth of the asphalt pavement around the perimeter of the area to be removed. Asphalt pavement not designated for pulverization shall be cold milled. The resulting milled material shall be used for re-installation on the project as Infield Surface Rock as described in P-152.

All milled asphalt material re-used on site shall meet the requirements of the material gradation in Table 1 below. Milled asphalt shall be free of objectionable material including existing crack seal and joint seal material, existing tiedowns, fence post sleeves, and rebar.

TABLE 1: ASPHALT MILLINGS GRADATION REQUIREMENTS

Sieve designation as per ASTM C 136	Percentage by weight passing sieves
2 inch	100
No. 10	20-100
No. 40	5-60
No. 200	0-15
Diameter 0.02 mm	Less than 3.0%

d. Repair or removal of Base, Subbase, and/or Subgrade. All failed material including surface, base course, subbase course, and subgrade shall be removed and repaired as shown on the plans or as directed by the CM. Materials and methods of construction shall comply with the applicable sections of these specifications. Any damage caused by Contractor's removal process shall be repaired at the Contractor's expense.

101-3.2 This section not used.

101-3.3 This section not used.

101-3.4 Concrete spall or failed asphaltic concrete pavement repair. This section not used.

101-3.5 Cold milling. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a uniform finished surface. The milling machine or grinder shall operate without tearing or gouging the underlaying surface. The milling machine or grinder shall be equipped with grade and slope controls, and a positive means of dust control. All millings shall be removed, processed, and installed in areas designated on the plans. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material removed with new material at the Contractor's Expense.

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

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of 7 feet (2 m) and it shall be equipped with electronic grade control devices that will cut the surface to the grade specified. The tolerances shall be maintained within +0 inch and -1/4 inch (+0 mm and -6mm) of the specified grade. The machine must cut vertical edges and have a positive method of dust control. The machine must have the ability to remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of in areas designated on the plans.

c. Clean-up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual materials are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow the surface to remove loose residual material. Waste materials shall be collected and removed from the pavement surface and adjacent areas by sweeping or vacuuming. Waste materials shall be removed and disposed off Airport property.

101-3.6. Preparation of asphalt pavement surfaces prior to surface treatment. This section not used.

101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the Engineer. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor's expense.

101-3.8 Preparation of Joints in Rigid Pavement prior to resealing. This section not used.

101-3.9 Preparation of Cracks in Flexible Pavement prior to sealing. This section not used.

101-3.9.4 Removal of Pipe and other Buried Structures.

a. Removal of Existing Pipe Material. Remove the types of pipe as indicated on the plans. The pipe material shall be legally disposed of off-site in a timely manner following removal. Trenches shall be backfilled with material equal to or better in quality than adjacent embankment. Trenches under paved areas must be compacted to 95% of ASTM D698

b. Removal of Storm Drain Inlets/Manholes. Where indicated on the plans or as directed by the CM, inlets and/or manholes shall be removed and legally disposed of off-site in a timely fashion after removal. Excavations after removal shall be backfilled with material equal or better in quality than adjacent embankment. Backfill shall be compacted to 95% of ASTM D698.

c. Removal of Trench Drains and Slot Drains. Where indicated on the plans or as directed by the CM, trench drains and slot drains shall be removed and legally disposed of off-site in a timely fashion after removal. Excavations after removal shall be backfilled with material equal or better in quality than adjacent embankment. Backfill shall be compacted to 95% of ASTM D698.

d. General. All existing items that need to be removed, whether specifically identified on the plans or not, and removal of those items is necessary for the progression of the work and are encountered within the established lines, grades, or grading sections, or as designated on the plans, shall be removed by the Contractor, unless such existing items are otherwise specified to be relocated, adjusted, salvaged, abandoned in place, reused in the work, or are designated to remain in place. The Contractor's removal plans and operations shall not cause damage to cables, utility ducts, pipelines, or drainage structures or other structures, pavements, or facilities under or adjacent to the pavement. Any damages, whether inadvertent or not, caused by the Contractor's actions shall be repaired by the Contractor at no expense to the airport Owner and to the satisfaction of the Engineer.

These project plans and specifications constitute the best available information for the site and facilities. However, the Contractor shall satisfy itself of all site facilities and items required to be removed and shall include all costs for complete removal and disposal of those items within the project limits or as required for completing the work. The Contractor is responsible for reviewing all demolition plans, all existing and

proposed utility plans, and all other project plans as they apply to demolition and removals, and shall inspect the site and verify the undertaking of all removals required for construction, prior to conducting the work. From this investigation, the Contractor shall submit a plan for the specific demolition activities, to the Engineer, for review and approval prior to commencement of all demolition activities. The Contractor shall consider in the demolition and removal plan any items that are required for salvage and handover to the Owner or other parties as identified in the Contract Documents.

All services shall be maintained throughout the duration of construction except for those systems designated for disconnection, removal, abandonment, or modification throughout the proposed utility plans. Existing and proposed utility plans and site demolition plans depict the best available information for the project site and the Engineer accepts no responsibility for unknown or non-specified removals beyond this specification or beyond what is shown on the project plans. The Contractor shall, through his own plan review and site inspection, be responsible for removal of all items shown, described, or implied throughout the limits of the project. The Contractor shall demonstrate to the Engineer that all remaining utilities and appurtenances are not a part of an active system and are therefore authorized for removal, prior to removal of any utility items. Pending that evaluation, the Contractor shall be authorized by the Engineer to commence removal of all utility items and appurtenances. If any active systems are encountered which cannot be taken out of service or cannot be removed and are in conflict with the proposed construction of this project, the Contractor shall immediately bring this to the Engineer's attention.

All materials and debris which are to be discarded shall be disposed of by the Contractor in accordance with the contract documents. Voids left below the new structural section shall be filled with crushed aggregate base and compacted to the requirements of subgrade preparation.

Removal items may include but are not limited to the following items, which the Contractor should anticipate encountering and shall be responsible for removing from the site:

Objects and Obstructions:

1. All catch basins, grates, collars, drainage swales, and all other assorted drainage structures or appurtenances.
2. Pavement markings designated for removal on the pavement marking plans.

Utility Items:

1. Underground electrical lighting facilities including junction boxes, pull boxes, electrical vaults, duct bank, conduit with slurry backfill, cable, raceways, grounding equipment systems, light cans with concrete foundations, and all appurtenances.
2. Water main piping, valves, valve boxes, meter boxes, utility covers, concrete collars, pipe restraints, thrust blocks, manholes, cleanouts, utility vaults and appurtenances.
3. Removal of storm drain manholes, catch basins, pipe plugs, storm drainage piping and associated appurtenances.

Pavement Markings:

1. Pavement markings, on pavement to remain, designated for removal on plans and/or as required to facilitate new pavement marking installations.

Other Assorted Items:

1. Any and all objects, obstructions, or other deleterious items which are located within the proposed construction prism of the project.

METHOD OF MEASUREMENT

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

101-4.2 Measurement for Removal of Existing Storm Drain Pipe will be by linear foot.

BASIS OF PAYMENT

101-5.1 Payment for pulverize existing asphalt pavement shall be made at contract unit price per square yard. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item. No additional payment shall be made for stockpiling material for use in other items for the project. No additional payment shall be made for the haul and placement of material in the disposal site indicated on the plans. No additional payment shall be made for sawcutting.

101-5.2 Payment for storm drain pipe removal, regardless of size or material, shall be paid at the contract unit price per linear foot per pipe size, which payment and price shall constitute full compensation for furnishing all labor, materials, tools equipment and incidentals necessary to remove the items from the project site and dispose of the materials in a legal manner, off airport property and backfilling the resultant void with suitable material. Removal of storm drain pipe shall include removal of all associated concrete encasements, fittings, and all appurtenances and temporary or permanent plugging of the utility at the limits of removal.

Payment will be made under:

- | | |
|--------------|---|
| Item P 101-1 | Pulverize Existing Asphalt Pavement (10 inches depth) – per square yard |
| Item P 101-2 | Remove Existing Storm Drain Pipe (Diameter varies) – per linear foot |

MATERIAL REQUIREMENTS

ASTM D6690	Standard Specification For Joint And Crack Sealants, Hot Applied, For Concrete And Asphalt Pavements
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END OF ITEM P-101

Item P-102 Airport Safety and Security

DESCRIPTION

102-1.1 General. This specification outlines safety procedures and regulations to be followed by the Contractor during the course of this work. The work item “Airport Safety and Security” shall consist of furnishing, installing, and removing temporary marking, signing, lighting, and barricades required during the course of this work to conform with FAA Advisory Circular 150/5370-2G “Operational Safety on Airports During Construction.” It shall also include furnishing sufficient flaggers, vacuum trucks, pilot cars and other required items for traffic control throughout the duration of the project. The Contractor shall be required to submit a Safety Plan to the Owner and have it approved prior to beginning construction activities.

Regulations for Contractors in Operating Areas – For the purpose and intent of these regulations, flight operation areas are construed to mean all areas restricted to public access on the field. The airport will remain in operation during the course of the contract work. The following operating regulations shall be adhered to at all times. The contractor shall indoctrinate all of his personnel and subcontractors on these regulations.

1. Prior to commencement of the work on any portion of the airport area, the Contractor shall schedule a meeting with the Construction Manager and Airport Manager to discuss and interview the personnel planned to operate any and all pilot vehicles and vacuum trucks during the course of construction. The Dunsmuir representative will have final approval authority of the selected driver(s). To the extent possible the driver(s) shall remain the same during the course of construction.
2. Absolutely no access to the Airport’s movement areas will be allowed without an active pilot vehicle, gate guard, flagger and other security measures as described within this specification and as deemed appropriate by the airport and RPR.
3. Prior to the commencement of any work within the Airport’s movement area, the Contractor must provide flaggers in the areas shown within the plans or as directed by the airport or RPR. If the RPR deems any one flagger to not meet expectations for flagging within the airport’s operational area, they shall be replaced immediately with another flagger that has met all the same criteria. To the extent possible the flaggers shall remain the same during the course of the project.
4. Should a winter shutdown occur, after the winter shut down and prior to starting construction again in the spring, the pilot vehicle and vacuum truck driver(s), flaggers and gate guards must attend an orientation meeting to reaffirm their aptitude regardless of their previous work.
5. Prior to commencement of the work on any of the airport’s operations apron area, the Contractor and the RPR will review the selected haul routes to be used by personnel and vehicles during the course of the work in various stages as shown within the drawings. The Contractor shall furnish, install, and maintain appropriate flaggers, traffic signs, barricades and pilot cars that clearly identify a haul route throughout its length within the flight operation area.
6. FAA approved orange and white-checkered flags or omni-directional amber flashing lights shall be provided by the Contractor on all vehicles and equipment.
7. During night operations, each vehicle shall be equipped with omni-directional amber flashing light mounted on the roof of the cab. Headlights, taillights, and flashers shall be used for all activities during these hours. FAA approved orange and white-checkered flags will not be sufficient during night hours when operating inside of the perimeter fence.

8. No construction activity will be allowed within 225 feet of the centerline of any active runway, within 65.5 feet of the centerline of an active taxiway or within 25 feet of parked aircraft without prior approval. The contractor shall notify the Construction Manager at least 48 hours prior to any need to do work inside these limits so that necessary notices or closures can be made. The Airport Authority will issue airport closures (NOTAMS).
9. No vehicles shall pass in front of taxiing aircraft or emergency vehicles at any time.
10. The flight operation area is immediately adjacent to the designated construction area. Activities beyond the construction limits will require prior clearance.
11. Construction equipment that extends 15 feet or more above ground level shall be cleared through the RPR. It shall be lighted at night in an approved manner and/or lowered to the height of adjacent structural surroundings at the discretion of the Engineer or RPR.
12. Welding equipment shall not be used within 100 feet of aircraft.
13. All accidents shall be reported to the RPR immediately.
14. In the event of an airport emergency, persons and equipment shall be moved immediately at the direction of the RPR or Owner.
15. The Contractor shall be responsible for ensuring that the construction area is kept free of construction debris, equipment, and/or materials that might endanger or be ingested by an aircraft.
16. The Contractor is required to provide a vacuum truck in any and all areas that construction activities commingle with aircraft or other vehicles within airport property. The vacuum truck shall be manned at all times during construction activity. The construction area shall be kept clean at all times.
17. The Contractor's Flaggers shall be equipped with Contractor supplied handheld ICOM VHF Air Band Transceivers model IC-A14, or approved equal, capable of monitoring ground and tower frequencies. All radios shall become the property of Dunsmuir Airport at the end of construction.
18. Contractor's access to the site shall be as shown on the plans. No other access points shall be allowed unless approved by the RPR or Owner. Contractor's traffic authorized to enter the site shall be experienced in the route or guided by contractor personnel. The contractor shall be responsible for traffic control to and from the various construction areas on the airport property. The contractor is responsible for immediate clean-up of any debris deposited along the delivery route to the storage area or work site shall be as directed by the RPR.
19. The Contractor shall notify the Engineer at least 48 hours in advance of the need to enter the work area. Absolutely no access to the work area will be given without prior consent. Delays to construction due to access restrictions will not be just cause for contract time extensions.

MATERIALS

102-2.1 Construction Safety and Phasing Plan (CSPP). The Contractor's attention is drawn towards the Special Provisions as well as the Construction Safety and Phasing Plan included within Volume III of these project documents. The contractor shall prepare their own Construction Safety and Phasing Plan in accordance with these documents for submission and approval by the Engineer. The project specific CSPP prepared by the contractor shall be submitted and approved prior to contractor's access being granted to the project site.

102-2.2 Barricades. Lighted low-level barricades marked with diagonal, alternating orange and white stripes shall be provided by the contractor and placed continuously as shown within plans and as directed by the Construction Manager. All low-level barricades shall have at least one steady burning red light

affixed to one of the ends. Orange lights will not be allowed. All barricades shall be firmly anchored against overturning and displacement from wind, jet blast, or prop wash. Should the Contractor need barrier rail within the construction zone, it shall be provided and removed by the Contractor. No direct payment will be made for flashing barricades or other types of barrier rail as described or for labor, equipment, and materials necessary to install them.

102-2.3 Temporary Marking and Signing. The Contractor shall install temporary signs, lights, traffic control devices, and other temporary markings other than striping required during the course of this contract. The temporary marking shall conform to applicable Federal Aviation Administration markings and shall be constructed of materials approved by the Engineer.

It is incumbent on the Contractor to consider these costs as they relate to his phasing plan and durations.

METHOD OF MEASUREMENT AND PAYMENT

102-3.1 The accepted pay quantity for “Airport Safety and Security” will be paid for at the contract unit price per month stated in the proposal. This price shall be full compensation including Contractor overhead and profit for furnishing flaggers, radios, barricades, lights, and other temporary markings as well as maintenance of those items during the duration of the project and for all labor, equipment tools and incidentals necessary to complete the item. This item shall be continued until such time as the Contractor has completed the contract to the satisfaction of the Engineer. The payment for this item shall not exceed the original contract time unless otherwise approved by the Engineer.

Payment will be made under:

Item P-102-1 Airport Safety and Security – per month

END OF ITEM P-102

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Item P-151 Clearing and Grubbing

DESCRIPTION

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

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

b. Clearing and grubbing shall consist of clearing the surface of the ground of the designated areas 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 RPR 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.

c. Tree Removal. Tree Removal shall consist of the cutting and removal of isolated single trees or isolated groups of trees, and the grubbing of stumps and roots. The removal of all the trees of this classification shall be in accordance with the requirements for the particular area being cleared.

CONSTRUCTION METHODS

151-2.1 General. The areas denoted on the plans to be cleared and grubbed shall be staked on the ground by the Contractor as indicated on the plans.

The removal of existing structures and utilities required to permit orderly progress of work shall be accomplished by local agencies, unless otherwise shown on the plans. Whenever a telephone pole, pipeline, conduit, sewer, roadway, or other utility is encountered and must be removed or relocated, the Contractor shall advise the RPR who will notify the proper local authority or owner to secure prompt action.

151-2.1.1 Disposal (Onsite). All materials removed by clearing or by clearing and grubbing shall be disposed of within the Airport's limits at the Contractor's responsibility, except when otherwise directed by the RPR. As far as practicable, waste concrete and masonry shall be placed on slopes of embankments or channels. When embankments are constructed of such material, this material shall be placed in accordance with requirements for formation of embankments. Any broken concrete or masonry that cannot be used in construction and all other materials not considered suitable for use elsewhere, shall be disposed of by the Contractor. In no case, shall any discarded materials be left in windrows or piles adjacent to or within the airport limits. The manner and location of disposal of materials shall be subject to the approval of the RPR and shall not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the airport property limits, the Contractor shall obtain and file with the RPR permission in writing from the property owner for the use of private property for this purpose.

151-2.1.2 Blasting. Blasting shall not be allowed.

151-2.2 Clearing. The Contractor shall clear the staked or indicated area of all materials as indicated on the plans. Trees unavoidably falling outside the specified clearing limits must be cut up, removed, and disposed of in a satisfactory manner. To minimize damage to trees that are to be left standing, trees shall be felled toward the center of the area being cleared. The Contractor shall preserve and protect from injury all trees not to be removed. The trees, stumps, and brush shall be cut flush with the original ground surface. The grubbing of stumps and roots will not be required.

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

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

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

All holes in 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.

METHOD OF MEASUREMENT

151-3.1 The quantities of clearing and grubbing as shown by the limits on the plans shall be the number of acres (square meters) or fractions thereof of land specifically cleared and grubbed.

BASIS OF PAYMENT

151-4.1 Payment shall be made at the contract unit price per acre (square meter) for clearing and grubbing. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-151-1 Clearing and grubbing - per acre

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, and intermediate areas as well as other areas for drainage, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

a. Excavation. Unclassified excavation shall consist of the excavation of all material, regardless of its nature.

b. Embankment. Embankment shall consist of the formation of onsite embankments with suitable material.

c. Export (On-site). Export (On-site) shall consist of the removal of excess excavated onsite material and pulverized material from the airport. The material shall be disposed of at the designated material stockpile area as shown within the plans.

d. Unsuitable Material. Unsuitable excavation material shall consist of deposits of mixtures of soils that contain deleterious material, organic matter or highly plastic material considered by the RPR not suitable for foundation material. Unsuitable materials shall include materials that will decay or produce subsidence in the embankment. Materials 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 on the embankment slope when approved by the RPR.

e. Stabilizing Fill. Stabilizing fill shall consist of furnishing, moving, placing, and compacting the below defined material as backfill. Stabilizing fill material shall be placed to the lines and grades as directed by the Owner or Engineer. The material shall be placed in 12-inch lifts and densified with a 20-ton minimum self-propelled tamping-foot compactor until no deflection/consolidation is observed. Gradation may be a visual determination by the Owner. However, if there is any disagreement, it shall be the Contractor's responsibility to verify the gradation by furnishing adequate scales, screens, labor, and equipment necessary to screen the material.

Stabilizing fill shall meet the following criteria:

SIEVE SIZE (Square Opening)	PERCENT PASSING (by Dry Weight)
12 in	100
6 in	30 - 70
2 in	0 - 15

f. Geotextile Fabric. A geotextile fabric will be placed over the stabilizing fill. The geotextile shall have the following properties:

GEOTEXTILE PROPERTIES	GEOTEXTILE MINIMUM STRENGTH VALUES
Grab Tensile Strength (ASTM D 4632)	270 lbs.
Mullen Burst (ASTM D 3786)	450 psi
Puncture (ASTM D 4833)	110 lbs.
Trapezoid Tear (ASTM D 4533)	75 lbs.

The geotextile fabric shall be placed with a minimum joint overlay of 3 feet. Placement should be such that construction equipment does not travel directly over the geotextile fabric. Subgrade Preparation shall not be measured nor paid in this area.

g. Subgrade Preparation: Subgrade preparation shall consist of any required scarifying, grading, adding or removing moisture, and compacting existing and proposed subgrade material in pavement areas to the depth and density shown on the plans.

h. Infield Surface Rock: Infield Surface Rock consists of the installation of loose gravel material (2"-minus) in conformance with the gradation parameters of the latest CalTrans Gravel Mulch Specification on the infield (unpaved) areas within the limits of construction. The contractor shall submit product sample for RPR and Owner review. The selected material shall be dark in color to provide ample contrast with pavement markings.

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared or cleared and grubbed in accordance with Item P-151.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed of in waste areas as shown on the plans. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or approved by the RPR.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the RPR notified per Section 70, subsection 70-20. At the direction of the RPR, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches (100 mm), to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150 mm) of the subgrade.

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 RPR, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

The Contractor shall excavate the site in such a manner that stockpiling of excavated materials or the use of offsite borrow materials will not be necessary. If the Contractor does desire to stockpile excavated material, prior approval must be obtained from the Engineer. When approved, temporary material stockpiling may occur in the Contractor's staging area shown on the Plans. Height restrictions for material stockpiles in the staging area shall be in accordance with Federal Aviation Regulation (FAR) Part 77 Civil Imaginary Surfaces. The Contractor shall control dust, erosion, and FOD related to the stockpiled material as required in the Plans and Specifications. No separate measurement or payment will be made for the use of material, excavated and stockpiled by the Contractor. If the Contractor desires to use offsite borrow material for backfill, prior approval must be obtained from the Engineer. No separate measurement or payment will be made for the offsite borrow material used for backfill or embankment by the Contractor.

a. Blasting. Blasting shall not be allowed.

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the RPR has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. The Contractor and RPR shall agree that the original ground lines shown on the original topographic mapping are accurate, or agree to any adjustments made to the original ground lines.

Digital terrain model (DTM) files of the existing surfaces, finished surfaces and other various surfaces were used to develop the design plans.

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 (30 mm) of the stated elevations for ground surfaces, or within 0.04 foot (12 mm) 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 the RPR 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.

All areas to be excavated shall be stripped of vegetation and surface rock. Surface rock shall be stockpiled for future use in areas designated on the plans or by the RPR. All suitable excavated material shall be used in the formation of embankment, subgrade, hauled to the disposal site or other purposes as shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

The grade shall be maintained so that the surface is well drained at all times.

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as

directed by the RPR. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the RPR 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. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches (300 mm) below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified by the RPR. Unsuitable materials shall be disposed off the airport. The cost is incidental to this item. This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for Owner Authorized Over Excavation.

c. Over-break. Over-break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the RPR. All over-break shall be graded or removed by the Contractor and disposed of as directed by the RPR. The RPR shall determine if the displacement of such material was unavoidable and their own decision shall be final. Payment will not be made for the removal and disposal of over-break that the RPR determines as avoidable. Unavoidable over-break will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor. 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 RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

e. Compaction requirements. The subgrade under areas to be paved shall be compacted to a depth and to a density as shown on the plans. The material to be compacted shall be within $\pm 2\%$ of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils).

The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150 mm) of the subgrade. The finished grading operations, conforming to the typical cross-section, shall be completed and maintained at least 1,000 feet (300 m) ahead of the paving operations or as directed by the Engineer.

All loose or protruding rocks on the back slopes of cuts shall be pried loose or otherwise removed to the slope finished grade line. All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the Engineer.

Blasting shall not be allowed.

f. Proof rolling. After compaction is completed, the subgrade area shall be proof rolled with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds (13.6 metric tons) and inflated to a minimum of 125 psi (0.861 MPa) in the presence of the RPR. Apply a minimum of two coverages, or as specified by the RPR, 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.

152-2.3 Borrow excavation. Borrow areas are not required.

152-2.4 Drainage excavation. Drainage excavation shall consist of excavating drainage ditches including intercepting, inlet, or outlet ditches; or other types as shown on the plans. The work shall be performed in sequence with the other construction. Ditches shall be constructed prior to starting adjacent excavation operations. All satisfactory material shall be placed in embankment fills; unsuitable material shall be placed in designated waste areas or as directed by the RPR. All necessary work shall be performed true to final line, elevation, and cross-section. The Contractor shall maintain ditches constructed on the project to the required cross-section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 Preparation of cut areas or areas where existing pavement has been removed. In those areas on which a subbase or base course is to be placed, the top of the subgrade shall be compacted to the maximum density and depth shown on the plans.

152-2.6 Preparation of embankment area. 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 per subsection 152-2.10.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches (300 mm) and compacted as specified for the adjacent fill.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

152-2.8 Formation of embankments. The material shall be constructed in lifts as established in the control strip, but not less than 6 inches (150 mm) nor more than 12 inches (300 mm) of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

The lifts shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the RPR. 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 due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each lift shall be within $\pm 2\%$ of optimum moisture content before rolling to obtain the prescribed compaction. The material shall be moistened or aerated as necessary to achieve a uniform moisture content throughout the lift. Natural drying may be accelerated by blending in dry material or manipulation alone to increase the rate of evaporation.

The Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content to achieve the specified embankment density.

The Contractor will take samples of excavated materials which will be used in embankment for testing to obtain a Moisture-Density Relations of Soils Report (Proctor) in accordance with ASTM D698. A new Proctor shall be obtained for each soil type based on visual classification.

Density tests will be taken by the Contractor for every 3,000 square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the RPR.

If the material has greater than 30% retained on the 3/4-inch (19.0 mm) sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.

Rolling operations shall be continued until the embankment is compacted to not less than maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D698. Under all areas to be paved, the embankments shall be compacted to a depth and to a density as shown in the plans. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

The in-place field density shall be determined in accordance with ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance. If the specified density is not attained, the area represented by the test or as designated by the RPR shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

Compaction areas shall be kept separate, and no lift shall be covered by another lift 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 lift is placed. Lift placement shall begin in the deepest portion of the embankment fill. As placement progresses, the lifts shall be constructed approximately parallel to the finished pavement grade line.

When rock, concrete pavement, asphalt pavement, and other embankment material are excavated at approximately the same time as the subgrade, the material shall be incorporated into the outer portion of the embankment and the subgrade material shall be incorporated under the future paved areas. Stones, fragmentary rock, and recycled pavement larger than 4 inches (100 mm) in their greatest dimensions will not be allowed in the top 12 inches (300 mm) of the subgrade. Rockfill shall be brought up in lifts as specified or as directed by the RPR and the finer material shall be used to fill the voids forming a dense,

compact mass. Rock, cement concrete pavement, asphalt pavement, and other embankment material shall not be disposed of except at places and in the manner designated on the plans or by the RPR.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in lifts of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in lifts not exceeding 2 feet (60 cm) in thickness. Each lift shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The lift shall not be constructed above an elevation 4 feet (1.2 m) below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in lifts, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for excavation, borrow, or other items.

152-2.9 Proof rolling. The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. Before start of embankment, and 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 80/100/150 psi (0.551 MPa/0.689 MPa/1.034 MPa) in the presence of the RPR. Apply a minimum of 15% coverage, or as specified by the RPR, under pavement 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. Removal and replacement of soft areas is incidental to this item.

152-2.10 Compaction requirements. The subgrade under areas to be paved shall be compacted to a depth and to a density as shown on the plans. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth and to a density as shown on the plans.

The material to be compacted shall be within $\pm 2\%$ of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). When the material has greater than 30 percent retained on the $\frac{3}{4}$ inch (19.0 mm) sieve, follow the methods in ASTM D698. Tests for moisture content and compaction will be taken at a minimum of 1,000 S.Y. of subgrade. All quality assurance testing shall be done by the Contractor's laboratory in the presence of the RPR, and density test results shall be furnished upon completion to the RPR for acceptance determination.

The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938 within 12 months prior to its use on this contract. The gage shall be field standardized daily.

Density tests will be taken by the RPR for every 1000 S.Y. of completed subgrade.

Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

If the specified density is not attained, the entire lot shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the RPR and the finished subgrade shall be maintained.

152-2.11 Finishing and protection of subgrade. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. 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. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.

152-2.12 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 repaired at the Contractor's expense.

The 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.

152-2.13 Surface Tolerances. In those areas on which a subbase or base course is to be placed, 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 re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

- a. **Smoothness.** The finished surface shall not vary more than $\pm \frac{1}{2}$ inch (12 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.
- b. **Grade.** The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within ± 0.05 feet (15 mm) of the specified grade.

On safety areas, turfed areas and other designated areas within the grading limits where no subbase or base is to be placed, grade shall not vary more than 0.10 feet (30 mm) from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.14 Owner Authorized Over Excavation. Owner Authorized Over excavation shall consist of the removal of material (i.e. unsuitable, saturated, etc.) and replacement with Suitable Material/Stabilizing Fill beyond the extent of excavation indicated on the Drawings. Pulverized material may be used provided that it meets the gradation requirements of P-207. In structural areas, the top 6" of over excavation (to top of subgrade) shall consist of Recycled Aggregate Base (P-207). This work shall only be done with written approval by the OWNER or RPR. Compaction for replacement materials shall be 100%.

152-2.15 Disposal Area Grading. As a last step, the disposal area shall be graded to allow positive drainage of the entire area and of adjacent areas as directed by the RPR. The entire area shall be proof rolled after grading as directed by the RPR prior to placing surface rock.

METHOD OF MEASUREMENT

152-3.1 General. All measurements of quantities shall be provided to Owner by Contractor and subsequently verified by Owner. Contractor is responsible for indicating to Owner all discrepancies between existing plan grades and existing grades found in the field prior to any earthwork. If discrepancies are not brought to Owner's attention then no claims may be made for differences earthwork quantities because of said discrepancy.

152-3.2 Excavation. The quantity of excavation, including existing aggregate base material not removed and placed under P-207, to be paid for shall be the number of cubic yards measured in its original position. Measurements shall be done by the Contractor with the Owner in attendance and shall be done by cross sectioning areas at 50-foot intervals.

Quantities for Excavation shall be computed by the average end area method. The end area is that bound by the original ground line, after pavement removal, and the planned top of subgrade as shown on the Drawings. The original ground line shall be established by field cross sections taken randomly at intervals not exceeding 50 foot grid, subject to verification by Owner.

Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed by the Owner or material excavated, placed and paid for under other items such as subgrade stabilization, saturated soils, stabilized soils, etc. There shall be no separate measurement for excavation of hard pan layer(s).

152-3.3 Embankment. Embankment shall be measured by the cubic yard in its final position for onsite materials, excluding Surface Rock, moved within the project limits to create the subgrade lines and grades as shown on the Drawings.

Quantities for Embankment shall be computed by the average end area method.

152-3.4 Export (On-site). Export (On-site) shall be measured by the cubic yard in its original position of excavated material that is excess to the project embankment and transported and deposited to designated disposal area(s) on Airport Property.

This item does not include Owner Authorized Over-Excavation, and materials from structural excavations and utility and drainage pipe trenching. The export on site of these materials is included under respective work and shall be subject to approval of the Owner.

152-3.5 Infield Surface Rock. Infield Surface Rock shall be measured by the square yard of CalTrans gravel mulch material in its final position, processed, transported/hailed, placed, and compacted in the areas specified on the Plans.

152-3.6 Owner Authorized Over-Excavation (Revocable). Owner Authorized Over-Excavation shall be measured by the cubic yard from its original position for excavation and removal to the designated disposal site and replacement with Suitable material/Stabilizing Fill and Geotextile Fabric, as determined by the RPR. Owner Authorized Over-Excavation shall not be measured for payment unless specifically directed in writing by the Owner or RPR.

152-3.7 Stabilizing Fill. Stabilizing fill shall not be measured for payment but shall be included under "Owner Authorized Over-Excavation".

152-3.8 Geotextile Fabric. Geotextile fabric shall not be measured for payment but shall be included under "Owner Authorized Over-Excavation".

152-3.9 Drainage Excavation. Drainage Excavation shall not be measured for payment but shall be included under respective work.

152-3.10 Stockpiled Material. Stockpiled Material, including all handling, re-handling, and placement of stockpiles, shall not be measured for payment but considered incidental to other items of work.

152-3.11 Subgrade Preparation. Subgrade preparation shall not be measured for payment but shall be included under respective work.

BASIS OF PAYMENT

152-4.1 Excavation. Payment for Excavation shall be made at the Contract Unit Price per cubic yard. This price shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the Item, including excavation, temporary stockpiling and re-handling of the materials to accommodate construction phasing.

152-4.2 Embankment. Payment for Embankment shall be made at the Contract Unit Price per cubic yard. This price shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the Item, including temporary stockpiling and re-handling of the materials to accommodate construction phasing.

152-4.3 Export (On-site). Payment for Export (On-site) shall be made at the Contract Unit Price per cubic yard. This price shall be considered as full compensation for furnishing all labor, materials, tools, equipment and incidentals for loading, hauling and disposing of excess soil material to designated disposal area(s) on Airport Property.

152-4.4 Infield Surface Rock. Payment for Infield Surface Rock shall be made at the contract unit price per square yard for CalTrans gravel mulch materials, hauled, placed, and compacted. This price shall be considered as full compensation for all labor, materials, tools, equipment and incidentals to complete the item, as well as processing, loading, hauling, placing, spreading, and compacting the infield surface rock in the areas designated on the Plans.

152-4.4 Subgrade Preparation. No separate payment shall be made for Subgrade preparation, but shall be considered incidental to the Items in which it is included.

152-4.5 Owner Authorized Over-Excavation (Revocable). Payment for Owner Authorized Over-Excavation shall be made at the Contract Unit Price per cubic yard. This price shall be considered as full compensation for furnishing all labor, materials, tools, equipment and incidentals for loosening, excavating, hauling, and disposing of Material off Airport Property and any costs associated with disposing of the material and the replacement with Suitable material/Stabilizing Fill as determined by the RPR.

152-4.6 Stabilizing Fill. Stabilizing fill shall not be paid for separately but shall be included under "Owner Authorized Over-Excavation"

152-4.7 Geotextile Fabric. Geotextile fabric shall not be paid for separately but shall be included under "Owner Authorized Over-Excavation"

152-4.8 Drainage Excavation. No separate payment shall be made for Drainage Excavation, but shall be considered incidental to the Items in which it is included.

152-4.9 Stockpiled Material. Stockpiled Material, including all handling, re-handling, and placement of stockpiles, shall not be paid for separately but considered incidental to other items of work.

152-4.10 Subgrade Preparation. No separate payment shall be made for Subgrade preparation, but shall be considered incidental to the Items in which it is included.

152-4.11 Payment. The basis of payment for the above Items of Work shall be full compensation for furnishing all material, labor, equipment, tools, and incidentals necessary to complete the excavation, grading, processing, screening, loading, hauling, placement, and incidentals, as required to complete the Work.

Payment will be made under:

Item P-152-1	Excavation - per cubic yard
Item P-152-2	Embankment - per cubic yard
Item P-152-3	Export (On-site) - per cubic yard
Item P-152-4	Infield Surface Rock (3 Inches Thick) – per square yard
Item P-152-5	Owner Authorized Over-Excavation (Revocable) - per cubic yard

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 D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-152

Part 4 – Base Courses

Item P-207 Recycled Asphalt Aggregate Base Course

DESCRIPTION

207-1.1 This item consists of a recycled asphalt aggregate base course resulting from the pulverization of the existing pavement section (asphalt wearing surface and aggregate base), plus mechanical stabilization with additional aggregate or chemical stabilization with cement, asphalt emulsion or fly ash when required.

MATERIALS

207-2.1 Aggregate. The aggregate shall consist of materials produced by recycling (processing and mixing) the existing asphalt pavement, aggregate base, and any additional aggregate as necessary. Material larger than 2 inches in any dimension shall not be permitted in the recycle asphalt aggregate base course.

The aggregate material shall exhibit a California Bearing Ratio (CBR) value of at least 30 when tested in accordance with ASTM D1883. The aggregate shall meet the gradation in the table below.

Gradation

Sieve	Minimum Percentage by weight passing sieves
2 inch (51 mm)	100
No. 4 (4.75 mm)	55
No. 40 (425 µm)	5-40
No. 200 (75 µm)	0-15

a. Deleterious substances. Materials for aggregate base shall be kept free from weeds, sticks, grass, roots and other foreign matter.

b. Uniformity. The materials shall be thoroughly recycled (pulverized and mixed) to ensure a uniform gradation.

207-2.2 Stabilization.

a. Mechanical stabilization. Not required.

b. Chemical Stabilization. Stabilizing agent is not required.

207-2.3 Water. Water used in mixing or curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

207-2.4 Quality Control (QC) Sampling and testing. The Contractor shall take at least two aggregate samples per day of production in the presence of the Resident Project Representative (RPR) to check the gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in subsection 207-2.1.

Samples shall be taken from the in-place, un-compacted material at random sampling locations per ASTM D3665.

CONSTRUCTION METHODS

207-3.1 Pulverizing. The existing asphalt pavement and aggregate base shall be pulverized to a depth of 10 inches below surface grade of the existing asphalt pavement as described and paid for in section P-101.

207-3.2 Control Strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the RPR. Upon acceptance of the control strip by the RPR, the Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

207-3.3 Mixing and Processing. The pulverized asphalt pavement and aggregate base shall be mixed and processed into a uniformly blended mixture and installed to the depth indicated on the plans. All material over approximately 2 inches (50 mm) shall be removed by the Contractor. The mixture shall be brought to the desired moisture content.

The maximum lift thickness of the recycled aggregate base course material to be compacted shall be 6 inches.

207-3.4 Grading and compaction. Upon completion and acceptance of the subgrade preparation, the base material shall be placed, shaped and graded in accordance with the project plans. The recycled asphalt aggregate base course shall be compacted to the in-place density indicated on the plans. The moisture content of the material during compaction shall be within $\pm 2\%$ of the optimum moisture content as determined by ASTM D2216. The number, type and weight of rollers shall be sufficient to compact the material to the required density. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

207-3.5 Finishing. The surface of the aggregate base course shall be finished by blading or with automated equipment designed for this purpose. If the top layer is 1/2 inch (12 mm) or more below grade, the top layer shall be scarified to a depth of at least 3 inches (75mm), new material added, and the layer blended and re-compacted to bring it to grade. The addition of layers less than 3 inches (75mm) shall not be allowed.

207-3.6 Proof rolling. Compacted asphalt aggregate base course shall be proof rolled with a tandem axle dual wheel dump truck loaded to the legal limit with tires inflated to 80 psi (550 kPa) in the presence of the RPR. Soft areas that deflect greater than 0.5 inch (12 mm) or show permanent deformation greater than 0.5 inch (12 mm) shall be removed and reworked at the Contractor's expense.

207-3.7 Weather limitations. When weather conditions detrimentally affect the construction process and/or quality of the materials, the Contractor shall stop construction. Cement or fly ash shall not be applied when wind conditions affect the distribution of the materials. When the aggregates contain frozen materials or when the underlying course is frozen or wet, the construction shall be stopped. Construction shall not be performed unless the atmospheric temperature is above 35°F (2°C) and rising or approved by the RPR. When the temperature falls below 35°F (2°C), protect all completed areas against detrimental effects of freezing by approved methods. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

207-3.8 Maintenance. The asphalt aggregate base course shall be maintained in a satisfactory condition until the work is accepted by the RPR. Equipment used in the construction of an adjoining section may be routed over completed sections of asphalt aggregate base course, provided that no damage results and equipment is routed over the full width of the completed asphalt aggregate base course. Any damage to the recycled asphalt aggregate base course shall be repaired by the Contractor at the Contractor's expense.

207-3.9 Surface tolerances. The finished surface shall be tested for smoothness and accuracy of grade. Any area failing smoothness or grade shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted by the Contractor at the Contractor's expense.

a. Smoothness. The finished surface shall not vary more than 3/8-inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade shall be measured on a 30-foot grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade.

207-3.10 Acceptance sampling and testing for density. Recycled base course shall be accepted for density and thickness on an area basis. One (1) test for density and thickness will be made for each 1000 square yds. Sampling locations will be determined on a random basis in accordance with ASTM D3665.

a. Density. Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance. The Contractor shall perform all density tests with the RPR present and observing.

Each area will be accepted for density when the field density is at least the density of the recycled base course in accordance with the plans. The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

b. Thickness. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by survey performed by the Contractor in the presence of the RPR before and after placement of the base. The survey shall be performed on a 25' grid by a licensed Professional Land Surveyor in the state of California. Where the thickness is deficient by more than 1/2-inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material, and recompacted to grade. The Contractor shall replace, at his or her expense, base material where depth tests have been taken.

METHOD OF MEASUREMENT

207-4.1 The quantity of recycled asphalt aggregate base course shall be measured by the number of square yards (m²) of material in compliance with the plans and specifications. All excess recycled asphalt aggregate base course shall be hauled and stockpiled at the disposal site as shown on the plans. There will be no separate measurement or payment for hauling and temporary stockpiling recycled asphalt aggregate base course material to accommodate other items of work.

BASIS OF PAYMENT

207-5.1 Payment shall be made at the contract unit price per square yard (m²) for processing the existing asphalt pavement, aggregate base course, and mixing with stabilizing agent, if required, spreading, compacting, and maintaining the recycled material to the compacted thickness as indicated on the drawings. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools and incidentals to complete the item, including temporary stockpiling and re-handling of the materials to accommodate other items of work.

Payment will be made under:

Item P-207-1 Recycled Asphalt Aggregate Base Course (7 Inches Thick) –per square yard

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.

ASTM International (ASTM)

ASTM C29	Unit Weight of Aggregate
ASTM C88	Soundness of Aggregates by Use of Sodium or Magnesium Sulfate
ASTM C117	Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregate by Washing
ASTM C131	Resistance to abrasion of Small Size Coarse Aggregate by Use of Los Angeles Machine
ASTM C136	Sieve or Screen Analysis of Fine and Coarse Aggregate
ASTM C150	Standard Specification for Portland Cement
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75	Sampling Aggregate
ASTM D558	ASTM D558 Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures
ASTM D698	Moisture Density Relations of Soils and Aggregate using 5.5 lb. Rammer and 12 in drop
ASTM D977	Standard Specification for Emulsified Asphalt
ASTM D1556	Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
ASTM D1557	Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D2216	Test Methods for Laboratory Determination of Water (Moisture) Soil and Rock by Mass
ASTM D2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate

ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4751	Standard Test Methods for Determining Apparent Opening Size of a Geotextile
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)
American Association of State Highway and Transportation Officials (AASHTO)	
M288	Standard Specification for Geosynthetic Specification for Highway Applications

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Part 6 – Flexible Pavements

Item P-403 Asphalt Pavement Mix Surface Course

DESCRIPTION

403-1.1 This item shall consist of pavement courses composed of mineral aggregate and asphalt binder mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

403-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The aggregates should have no known history of detrimental pavement staining due to ferrous sulfides, such as pyrite. Coarse aggregate is the material retained on the No. 4 (4.75 mm) sieve. Fine aggregate is the material passing the No. 4 (4.75 mm) sieve.

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 asphalt material and free from organic matter and other deleterious substances. Coarse aggregate material requirements are given in the table below.

Coarse Aggregate Material Requirements

Material Test	Requirement	Standard
Resistance to Degradation	Loss: 40% maximum for surface, asphalt binder, and leveling course Loss: 50% maximum for base course	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Clay lumps and friable particles	0.3% maximum	ASTM C142
Percentage of Fractured Particles	For pavements designed for aircraft gross weights of 60,000 pounds (27200 kg) or more: Minimum 75% by weight of particles with at least two fractured faces and 85% with at least one fractured face ¹	ASTM D5821
	For pavements designed for aircraft gross weights less than 60,000 pounds (27200 kg): Minimum 50% by weight of particles with at least two fractured faces and 65% with at least one fractured face ¹	
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles with a value of 5:1 ²	ASTM D4791
Bulk density of slag ³	Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)	ASTM C29.

¹ 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.

² A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

³ Only required if slag is specified.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel and shall be free from coatings of clay, silt, or other objectionable matter. Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. Fine aggregate material requirements are listed in the table below.

Fine Aggregate Material Requirements

Material Test	Requirement	Standard
Liquid limit	25 maximum	ASTM D4318
Plasticity Index	4 maximum	ASTM D4318
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Clay lumps and friable particles	0.3% maximum	ASTM C142
Sand equivalent	45 minimum	ASTM D2419
Natural Sand	The use of natural sand is not permitted.	ASTM D1073

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler.

403-2.2 Mineral filler. Mineral filler (baghouse fines) may be added in addition to material naturally present in the aggregate. Mineral filler shall meet the requirements of ASTM D242.

Mineral filler Requirements

Material Test	Requirement	Standard
Plasticity Index	4 maximum	ASTM D4318

403-2.3 Asphalt binder. Asphalt binder shall conform to ASTM D6373 Performance Grade (PG)76-28.

Asphalt Binder PG Plus Test Requirements

Material Test	Requirement	Standard
Elastic Recovery	75% minimum	ASTM D6084

403-2.4 Anti-stripping agent. Any anti-stripping agent or additive (anti-strip) shall be heat stable and shall not change the asphalt binder grade beyond specifications. Anti-strip shall be an approved material of the Department of Transportation of the State in which the project is located.

COMPOSITION

403-3.1 Composition of mixture. The asphalt plant 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).

403-3.2 Job mix formula (JMF) laboratory. The laboratory used to develop the JMF shall possess a current certificate of accreditation, listing D3666 from a national accrediting authority and all test methods required for developing the JMF, and listed on the accrediting authority's website. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

403-3.3 Job mix formula (JMF). No asphalt mixture shall be placed until an acceptable mix design has been submitted to the RPR for review and accepted in writing. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

When the project requires asphalt mixtures of differing aggregate gradations and/or binders, a separate JMF shall be submitted for each mix. Add anti-stripping agent to meet tensile strength requirements.

The JMF shall be prepared by an accredited laboratory that meets the requirements of subsection 403-3.2. The asphalt mixture shall be designed using procedures contained in Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples shall be prepared and compacted using the gyratory compactor in accordance with ASTM D6925.

Should a change in sources of materials be made, a new JMF must be submitted to the RPR for review and accepted in writing before the new material is used. After the initial production JMF has been approved by the RPR and a new or modified JMF is required for whatever reason, the subsequent cost of the new or modified JMF, including a new control strip when required by the RPR, will be borne by the Contractor.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

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 proposed for project use.

The submitted JMF shall be dated, and stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items as a minimum:

- Manufacturer's Certificate of Analysis (COA) for the asphalt binder used in the JMF in accordance with subsection 403-2.3. Certificate of asphalt performance grade is with modifier already added, if used and must indicate compliance with ASTM D6373. For plant modified asphalt binder, certified test report indicating grade certification of modified asphalt binder.
- Manufacturer's Certificate of Analysis (COA) for the anti-stripping agent if used in the JMF in accordance with subsection 403-2.4.
- Certified material test reports for the course and fine aggregate and mineral filler in accordance with subsections 403-2.1 and 403-2.2.
- Percent passing each sieve size for individual gradation of each aggregate cold feed and/or hot bin; percent by weight of each cold feed and/or hot bin used; and the total combined gradation in the JMF.
- Specific Gravity and absorption of each course and fine aggregate.
- Percent natural sand.
- Percent fractured faces.
- Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).
- Percent of asphalt.
- Number of blows or gyrations.
- Laboratory mixing and compaction temperatures.
- Supplier recommended mixing and compaction temperatures.

- Plot of the combined gradation on the 0.45 power gradation curve.
- Graphical plots of air voids, voids in the mineral aggregate (VMA), and unit weight versus asphalt content. To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.
- Tensile Strength Ratio (TSR).
- Type and amount of Anti-strip agent when used.
- Hamburg Wheel Test results.
- Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season shall not be accepted.
- Percentage and properties (asphalt content, asphalt binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with subsection 403-3.4, Reclaimed Hot-Mix Asphalt, if RAP is used.

Table 1. Asphalt Design Criteria

Test Property	Value	Test Method
Number of blows/gyrations	50	
Air voids (%)	3.5	ASTM D3203
Percent voids in mineral aggregate (VMA), minimum	See Table 2	ASTM D6995
TSR ¹	not less than 80 at a saturation of 70-80%	ASTM D4867
Hamburg Wheel Test	10 mm @ 20,000 passes at 50°C	AASHTO T324

¹ Test specimens for TSR shall be compacted at 7 ± 1.0 % air voids. In areas subject to freeze-thaw, use freeze-thaw conditioning in lieu of moisture conditioning per ASTM D4867.

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 2 when tested in accordance with ASTM C136 and ASTM C117.

The gradations in Table 2 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 2. Aggregate - Asphalt Pavements

Sieve Size	Percentage by Weight Passing Sieve
1 inch (25.0 mm)	100
3/4 inch (19.0 mm)	90-100
1/2 inch (12.5 mm)	68-88
3/8 inch (9.5 mm)	60-82
No. 4 (4.75 mm)	45-67
No. 8 (2.36 mm)	32-54
No. 16 (1.18 mm)	22-44
No. 30 (600 µm)	15-35
No. 50 (300 µm)	9-25
No. 100 (150 µm)	6-18
No. 200 (75 µm)	3-6
Voids in Mineral Aggregate (VMA)¹	14
Asphalt Percent:	
Stone or gravel	4.5-7.0
Slag	5.0-7.5
Recommended Minimum Construction Lift Thickness	3 inch

¹To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.

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.

403-3.4 Reclaimed Asphalt Pavement (RAP). RAP shall not be used

403-3.5 Control strip. Full production shall not begin until an acceptable control strip has been constructed and accepted in writing by the RPR. The Contractor shall prepare and place a quantity of asphalt according to the JMF. The underlying grade or pavement structure upon which the control strip is to be constructed shall be the same as the remainder of the course represented by the control strip.

The Contractor will not be allowed to place the control strip until the Contractor quality control program (CQCP), showing conformance with the requirements of paragraph 403-5.1, has been accepted, in writing, by the RPR.

The control strip will consist of at least 250 tons (227 metric tons) or 1/2 subplot, whichever is greater. The control strip shall be placed in two lanes of the same width and depth to be used in production with a longitudinal cold joint. The cold joint must be cut back in accordance with paragraph 403-4.13 using the same procedure that will be used during production. The cold joint for the control strip will be an exposed construction joint at least four (4) hours old or when the mat has cooled to less than 160°F (71°C). The equipment used in construction of the control strip shall be the same type, configuration and weight to be used on the project.

The control strip shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 403-6.1 and 403- 6.2.

The control strip will be considered acceptable by the RPR if the gradation, asphalt content, and VMA are within the action limits specified in paragraph 403-5.5a; and Mat density greater than or equal to 94%, air voids 3.5% +/- 1%, and joint density greater than or equal to 92%.

If the control strip is unacceptable, necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made and another control strip shall be placed. Unacceptable control strips shall be removed at the Contractor's expense.

The control strip will be considered one lot for payment based upon the average of a minimum of 3 samples (no sublots required for control strip). Payment will only be made for an acceptable control strip in accordance with paragraph 403-8.1.

CONSTRUCTION METHODS

403-4.1 Weather limitations. The asphalt 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 RPR, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)	
	Degrees F	Degrees 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

403-4.2 Asphalt plant. Plants used for the preparation of asphalt shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 including the following items:

a. Inspection of plant. The RPR, or RPR'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.

b. Storage bins and surge bins. The asphalt mixture stored in storage and/or surge bins shall meet the same requirements as asphalt mixture loaded directly into trucks. Asphalt mixture shall not be stored in storage and/or surge bins for a period greater than twelve (12) hours. If the RPR determines there is an excessive heat loss, segregation or oxidation of the asphalt mixture due to temporary storage, temporary storage shall not be allowed.

403-4.3 Aggregate stockpile management. Aggregate stockpiles shall be constructed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used.

A continuous supply of materials shall be provided to the work to ensure continuous placement.

403-4.4 Hauling equipment. Trucks used for hauling asphalt shall have tight, clean, and smooth metal beds. To prevent the asphalt 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 RPR. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the

mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

403-4.4.1 Material transfer vehicle (MTV). A material transfer vehicle is not required.

403-4.5 Asphalt pavers. Asphalt pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of asphalt that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface. The asphalt paver shall be equipped with a control system capable of automatically maintaining the specified screed grade and elevation.

If 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.

The paver shall be capable of paving to a minimum width specified in subsection 401-4.11.

403-4.6 Rollers. The number, type, and weight of rollers shall be sufficient to compact the asphalt to the required density while it is still in a workable condition without crushing of the aggregate, depressions or other damage to the pavement surface. Rollers shall be in good condition, capable of operating at slow speeds to avoid displacement of the asphalt. All rollers shall be specifically designed and suitable for compacting asphalt 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.

403-4.6.1 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 density gauge and obtain accurate density readings for all new asphalt. These densities shall be supplied to the RPR upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

403-4.7 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 material to the mixer at a uniform temperature. The temperature of the 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.

403-4.8 Preparation of mineral aggregate. The aggregate for the asphalt 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.

403-4.9 Preparation of asphalt mixture. 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 asphalt upon discharge shall not exceed 0.5%.

403-4.10 Application of Prime and Tack Coat. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.

A prime coat in accordance with Item P-602 shall be applied to aggregate base prior to placing the asphalt mixture.

A tack coat shall be applied in accordance with Item P-603 to all vertical and horizontal asphalt and concrete surfaces prior to placement of the first and each subsequent lift of asphalt mixture.

403-4.11 Laydown plan, transporting, placing, and finishing. Prior to the placement of the asphalt, the Contractor shall prepare a laydown plan with the sequence of paving lanes and width to minimize the number of cold joints; the location of any temporary ramps; laydown temperature; and estimated time of completion for each portion of the work (milling, paving, rolling, cooling, etc.). The laydown plan and any modifications shall be approved by the RPR.

Deliveries shall be scheduled so that placing and compacting of asphalt 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 approximately ambient temperature. The Contractor, at their expense, shall be responsible for repair of any damage to the pavement caused by hauling operations.

Contractor shall survey each lift of asphalt surface course and certify to RPR that every lot of each lift meets the grade tolerances of subsection 401-6.2e before the next lift can be placed.

Edges of existing asphalt pavement abutting the new work shall be saw cut and the cut off material and laitance removed. Apply a tack coat in accordance with P-603 before new asphalt material is placed against it.

The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Placement of the asphalt mix shall begin along the centerline of a crowned section or on the high side of areas with a one way slope unless shown otherwise on the laydown plan as accepted by the RPR. The asphalt mix shall be placed in consecutive adjacent lanes having a minimum width of **15** feet except where edge lanes require less width to complete the area. Additional screed sections attached to widen the paver to meet the minimum lane width requirements must include additional auger sections to move the asphalt mixture uniformly along the screed extension.

The longitudinal joint in one course shall offset the longitudinal joint in the course 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. Transverse joints in one course shall be offset by at least 10 feet (3 m) from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet (3 m). On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the asphalt may be spread and luted by hand tools.

The RPR may at any time, reject any batch of asphalt, on the truck or placed in the mat, which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or overheated asphalt mixture. 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 RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

Areas of segregation in the surface course, as determined by the RPR, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of the construction lift thickness as specified in subsection 401-3.3, Table 2 for the approved mix design. The

area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet (3 m) long.

403-4.12 Compaction of asphalt mixture. After placing, the asphalt mixture shall be thoroughly and uniformly compacted by self-propelled rollers. The surface shall be compacted as soon as possible when the asphalt 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 surface defects and/or displacement occurring as a result of the roller, or from any other cause, shall be corrected at the Contractor's expense.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross-section, and the required field density is obtained. To prevent adhesion of the asphalt to the roller, the wheels shall be equipped with a scraper and kept moistened with water as necessary.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power tampers.

Any asphalt that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

403-4.13 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 asphalt 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 asphalt 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 cut back with a cutting wheel or pavement saw a maximum of 3 inches (75 mm) to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material and any laitance produced from cutting joints shall be removed from the project. An asphalt tack coat or other product approved by the RPR shall be applied to the clean, dry joint prior to placing any additional fresh asphalt against the joint. The cost of this work shall be considered incidental to the cost of the asphalt.

403-4.14 Saw-cut grooving. Saw-cut grooving is not required.

403-4.15 Diamond grinding. Diamond grinding shall be completed prior to pavement grooving. Diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive.

Diamond grinding shall be performed with a machine designed specifically for diamond grinding capable of cutting a path at least 3 feet (0.9 m) wide. The saw blades shall be 1/8-inch (3-mm) wide with a minimum of 55 to 60 blades per 12 inches (300 mm) of cutting head width; grooves between 0.090 and 0.130 inches (2 and 3.5 mm) wide; and peaks and ridges approximately 1/32 inch (1 mm) higher than the bottom of the grinding cut. The actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Equipment or grinding procedures that causes ravels, aggregate fractures, spalls or disturbance to the pavement will not be permitted.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. The Contractor shall apply a surface treatment per P-608 to all areas that have been subject to grinding.

403-4.16 Nighttime Paving Requirements. The Contractor shall provide adequate lighting during any nighttime construction. A lighting plan shall be submitted by the Contractor and approved by the RPR prior to the start of any nighttime work. All work shall be in accordance with the approved CSPP and lighting plan.

CONTRACTOR QUALITY CONTROL (CQC)

403-5.1 General. The Contractor shall develop a CQCP in accordance with Item C-100. No partial payment will be made for materials that are subject to specific QC requirements without an approved CQCP.

403-5.2 Contractor quality control (QC) facilities. The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC 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.

403-5.3 Quality Control (QC) testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved CQCP. 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 QC Testing Plan shall be developed as part of the CQCP.

a. Asphalt content. A minimum of two tests shall be performed per day in accordance with ASTM D6307 or ASTM D2172 for determination of asphalt content. When using ASTM D6307, the correction factor shall be determined as part of the first test performed at the beginning of plant production; and as part of every tenth test performed thereafter. The asphalt content for the day will be determined by averaging the test results.

b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444 and ASTM C136, and ASTM C117.

c. Moisture content of aggregate. The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C566.

d. Moisture content of asphalt. The moisture content of the asphalt shall be determined once per lot in accordance with AASHTO T329 or 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 asphalt at the plant, and the asphalt 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. Smoothness for Contractor Quality Control. The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing

pavement with variances less than ¼ inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues

The Contractor may use a 12-foot (3.7 m) “straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start 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. Testing shall be continuous across all joints. The 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 the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using the FAA profile program, ProFAA, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

(1) Transverse measurements. Transverse measurements shall be taken for each day’s production placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet (15 m) or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day’s production 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 (6 m); and at the third points of paving lanes when widths of paving lanes are 20 ft (6 m) or greater.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch (6 mm) shall be corrected with diamond grinding per subsection 403-4.15 or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in subsection 401-6.1d(3). Areas that have been ground shall be sealed with a surface treatment in accordance with Item P-608. To avoid the surface treatment creating any conflict with runway or taxiway markings, it may be necessary to seal a larger area.

Control charts shall be kept to show area of each day’s placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor’s machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day’s production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade shall be evaluated daily to allow adjustments to paving operations when grade measurements do not meet specifications. As a minimum, grade shall be evaluated prior to the placement of the first lift and then prior to and after placement of the surface lift.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically and 0.1 feet (30 mm) laterally. The documentation will be provided by the Contractor to the RPR by the end of the following working day.

Areas with humps or depressions that exceed grade or smoothness criteria and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch (12 mm) less than the thickness specified on the plans. Grinding shall be in accordance with subsection 403-4.15.

The Contractor shall repair low areas or areas that cannot be corrected by grinding by removal of deficient areas to the depth of the final course plus 1/2 inch and replacing with new material. Skin patching is not allowed.

403-5.4 Sampling. When directed by the RPR, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

403-5.5 Control charts. The Contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each day shall be calculated and monitored by the QC laboratory.

Control charts shall be posted in a location satisfactory to the RPR and 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 RPR 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 JMF 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 (19.0 mm)	±6%	±9%
1/2 inch (12.5 mm)	±6%	±9%
3/8 inch (9.5 mm)	±6%	±9%
No. 4 (4.75 mm)	±6%	±9%
No. 16 (1.18 mm)	±5%	±7.5%
No. 50 (300 µm)	±3%	±4.5%
No. 200 (75 µm)	±2%	±3%
Asphalt Content	±0.45%	±0.70%
Minimum VMA	-0.5%	-1.0%

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
(n = 2)

Sieve	Suspension Limit
1/2 inch (12.5 mm)	11%
3/8 inch (9.5 mm)	11%
No. 4 (4.75 mm)	11%
No. 16 (1.18 mm)	9%
No. 50 (300 µm)	6%
No. 200 (75 µm)	3.5%
Asphalt Content	0.8%

c. Corrective action. The CQCP 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.

MATERIAL ACCEPTANCE

403-6.1. Quality Assurance 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 RPR at no cost to the Contractor except that coring as required in this section shall be completed and paid for by the Contractor.

a. Quality Assurance (QA) testing laboratory. The QA testing laboratory performing these acceptance tests will be accredited in accordance with ASTM D3666. The QA laboratory accreditation will be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing will be listed on the lab accreditation.

b. Lot Size. A standard lot will be equal to one day's production divided into approximately equal sublots of between 400 to 600 tons. When only one or two sublots are produced in a day's production, the sublots will be combined with the production lot from the previous or next day.

Where more than one plant is simultaneously producing asphalt for the job, the lot sizes will apply separately for each plant.

c. Asphalt air voids. Plant-produced asphalt will be tested for air voids on a subplot basis.

(1) Sampling. Material from each subplot shall be sampled in accordance with ASTM D3665. Samples shall be taken from material deposited into trucks at the plant or at the job site in accordance with ASTM D979. The sample of asphalt 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 maintain the material at or above the compaction temperature as specified in the JMF.

(2) Testing. Air voids will be determined for each subplot in accordance with ASTM D3203 for a set of compacted specimens prepared in accordance with ASTM D6926.

d. In-place asphalt mat and joint density. Each subplot will be tested for in-place mat and joint density as a percentage of the theoretical maximum density (TMD).

(1) Sampling. The Contractor will cut minimum 5 inches (125 mm) diameter samples in accordance with ASTM D5361. The Contractor shall furnish all tools, labor, and materials for cleaning, and filling the cored pavement. Laitance produced by the coring operation shall be removed immediately after coring, and core holes shall be filled within one day after sampling in a manner acceptable to the RPR.

(2) Bond. Each lift of asphalt shall be bonded to the underlying layer. If cores reveal that the surface is not bonded, additional cores shall be taken as directed by the RPR to determine the extent of unbonded areas. Unbonded areas shall be removed by milling and replaced at no additional cost as directed by the RPR.

(3) Thickness. Thickness of each lift of surface course will be evaluated by the RPR for compliance to the requirements shown on the plans after any necessary corrections for grade. Measurements of thickness will be made using the cores extracted for each subplot for density measurement. The maximum allowable deficiency at any point will not be more than 1/4 inch (6 mm) less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, will not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or subplot 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 RPR to circumscribe the deficient area.

(4) Mat density. One core shall be taken from each subplot. Core locations will be determined by the RPR in accordance with ASTM D3665. Cores for mat density shall not be taken closer than one foot (30 cm) from a transverse or longitudinal joint. The bulk specific gravity of each cored sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each subplot sample by the TMD for that subplot.

(5) Joint density. One core centered over the longitudinal joint shall be taken for each subplot which contains a longitudinal joint. Core locations will be determined by the RPR in accordance with ASTM D3665. The bulk specific gravity of each core sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each joint density sample by the average TMD for the lot. The TMD used to determine the joint density at joints formed between lots will be the lower of the average TMD values from the adjacent lots.

403-6.2 Acceptance criteria.

a. General. Acceptance will be based on the implementation of the Contractor Quality Control Program (CQCP) and the following characteristics of the asphalt and completed pavements: air voids, mat density, joint density, and grade.

b. Air voids. Acceptance of each lot of plant produced material for air voids will be based upon the average air void from the sublots. If the average air voids of the lot are equal to or greater than 2% and equal to or less than 5%, then the lot will be acceptable. If the average is below 2% or greater than 5%, the lot shall be removed and replaced at the Contractor's expense.

c. Mat density. Acceptance of each lot of plant produced material for mat density will be based on the average of all of the densities taken from the sublots. If the average mat density of the lot so established equals or exceeds 94%, the lot will be acceptable. If the average mat density of the lot is below 94%, the lot shall be removed and replaced at the Contractor's expense.

d. Joint density. Acceptance of each lot of plant produced asphalt for joint density will be based on the average of all of the joint densities taken from the sublots. If the average joint density of the lot so established equals or exceeds 92%, the lot will be acceptable. If the average joint density of the lot is less than 92%, the Contractor shall stop production and evaluate the method of compacting joints. Production

may resume once the reason for poor compaction has been determined and appropriate measures have been taken to ensure proper compaction.

e. Grade. The final finished surface of the pavement of the completed project shall be surveyed to verify that the grade elevations and cross-sections shown on the plans do not deviate more than 1/2 inch (12 mm) vertically or 0.1 feet (30 mm) laterally.

Cross-sections of the pavement shall be taken at a minimum 50-foot longitudinal spacing and at all longitudinal grade breaks.

The survey and documentation shall be stamped and signed by a licensed surveyor. Payment for sublots that do not meet grade for over 25% of the subplot shall not be more than 95%.

f. Profilograph roughness for QA Acceptance. The final profilograph shall be the full length of the project to facilitate testing of roughness between lots. The Contractor, in the presence of the RPR shall perform a profilograph roughness test on the completed project with a profilograph meeting the requirements of ASTM E1274 or a Class I inertial profiler meeting ASTM E950. Data and results shall be provided within 48 hrs of profilograph roughness tests.

The pavement shall have an average profile index less than 15 inches per mile per 1/10 mile. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2- inch (5 mm) blanking band. The bump template must span one inch (25 mm) with an offset of 0.4 inches (10 mm). The profilograph must be calibrated prior to use and operated by a factory or State DOT approved, trained operator. Profilograms shall be recorded on a longitudinal scale of one inch (25 mm) equals 25 feet (7.5 m) and a vertical scale of one inch (25 mm) equals one inch (25 mm). Profilograph shall be performed one foot right and left of project centerline and 15 feet (4.5 m) right and left of project centerline. Any areas that indicate “must grind” shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course, as directed by the RPR. Where corrections are necessary, a second profilograph run shall be performed to verify that the corrections produced an average profile index of 15 inches per mile per 1/10 mile or less.

403-6.3 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 RPR. A retest will consist of all the sampling and testing procedures contained in subsections 403-6.1. Only one resampling per lot will be permitted.

(1) A redefined mat density will be calculated for the resampled lot. The number of tests used to calculate the redefined mat density will include the initial tests made for that lot plus the retests.

(2) The cost for resampling and retesting shall be borne by the Contractor.

b. Payment for resampled lots. The redefined mat density for a resampled lot will be used to evaluate the acceptance of that lot in accordance with subsection 403-6.2.

c. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and density determined using the remaining test values.

METHOD OF MEASUREMENT

403-7.1 Measurement. Asphalt shall be measured by the number of square yards of asphalt used in the accepted work.

BASIS OF PAYMENT

403-8.1 Payment. Payment for a lot of asphalt mixture meeting all acceptance criteria as specified in subsection 403-6.2 shall be made at the contract unit price per square yard for asphalt. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-403-1 Hot Mix Asphalt (HMA) Pavement Surface Course (3 Inches Thick) - per square yard

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.

ASTM International (ASTM)

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- μ m (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 C142	Standard Test Method for Clay Lumps and Friable Particles in 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 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 D979	Standard Practice for Sampling Bituminous Paving Mixtures
ASTM D1073	Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D1074	Standard Test Method for Compressive Strength of Bituminous 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 D2172	Standard Test Method for Quantitative Extraction of Bitumen from 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 D3381	Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
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 D4125	Standard Test Methods for Asphalt Content of Bituminous mixtures by the Nuclear Method
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4552	Standard Practice for Classifying Hot-Mix Recycling Agents
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 D5581	Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen)
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6307	Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
ASTM D6373	Standard Specification for Performance Graded Asphalt Binder
ASTM D6752	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method
ASTM D6925	Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the SuperPave Gyratory Compactor
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 D6995	Standard Test Method for Determining Field VMA based on the Maximum Specific Gravity of the Mix (Gmm)
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E2133	Standard Test Method for Using a Rolling Inclinator to Measure Longitudinal and Transverse Profiles of a Traveled Surface
American Association of State Highway and Transportation Officials (AASHTO)	
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
AASHTO T 340	Standard Method of Test for Determining the Rutting Susceptibility of Hot Mix Asphalt (APA) Using the Asphalt Pavement Analyzer (APA)
Asphalt Institute (AI)	
MS-2	Mix Design Manual, 7th Edition
MS-26	Asphalt Binder Handbook AI State Binder Specification Database
FAA Orders	
5300.1	Modifications to Agency Airport Design, Construction, and Equipment Standards
Federal Highway Administration (FHWA)	
Long Term Pavement Performance Binder program	
Software	
FAARFIELD	

END OF ITEM P-403

Part 9 – Miscellaneous

Item P-602 Emulsified Asphalt Prime Coat

DESCRIPTION

602-1.1 This item shall consist of an application of emulsified asphalt material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

602-2.1 Emulsified Asphalt material. The emulsified asphalt material shall be as specified in ASTM D3628 for use as a prime coat appropriate to local conditions. The Contractor shall provide a copy of the manufacturer's Certificate of Analysis (COA) for the emulsified asphalt material. The COA shall be provided to and approved by the Resident Project Representative (RPR) before the emulsified asphalt material is applied. The furnishing of the COA for the emulsified asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

CONSTRUCTION METHODS

602-3.1 Weather limitations. The emulsified asphalt prime coat shall be applied only when the existing surface is dry; the atmospheric temperature is 50°F (10°C) or above, and the temperature has not been below 35°F (2°C) for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the RPR.

602-3.2 Equipment. The equipment shall include a self-powered pressure asphalt material distributor and equipment for heating asphalt 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 asphalt material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 1.0 gallons per square yard (0.23 to 4.5 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 asphalt material manually to areas inaccessible to the distributor. Equip the distributor to circulate and agitate the asphalt material during the heating process. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

A power broom and power blower suitable for cleaning the surfaces to which the asphalt coat is to be applied shall be provided.

Asphalt distributors must be calibrated annually in accordance with ASTM D2995. The Contractor must furnish a current calibration certification for the asphalt distributor truck from any State or other agency as approved by the RPR.

602-3.3 Application of emulsified asphalt material. Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material.

The asphalt emulsion material shall be uniformly applied with an asphalt distributor at the rate of 0.15 to 0.30 gallons per square yard (0.68 to 1.36 liters per square meter) depending on the base course surface texture. The type of asphalt material and application rate shall be approved by the RPR prior to application.

Following application of the emulsified asphalt material and prior to application of the succeeding layer of pavement, allow the asphalt coat to cure and to obtain evaporation of any volatiles or moisture. Maintain the coated surface until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread sand to effectively blot up and cure excess asphalt material. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the Owner. Keep traffic off surfaces freshly treated with asphalt material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

602-3.4 Trial application rates. The Contractor shall apply a minimum of three lengths of at least 100 feet (30 m) for the full width of the distributor bar to evaluate the amount of emulsified asphalt material that can be satisfactorily applied with the equipment. Apply three different application rates of emulsified asphalt materials within the application range specified in subsection 602-3.3. Other trial applications can be made using various amounts of material as directed by the RPR. The trial application is to demonstrate the equipment can uniformly apply the emulsified asphalt material within the rates specified and determine the application rate for the project.

602-3.5 Freight and waybills. The Contractor shall submit waybills and delivery tickets during the progress of the work. Before the final estimate is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt 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 AND BASIS OF PAYMENT

602-4.1 No separate measurement or payment shall be made for emulsified asphalt prime coat; it shall be considered a subsidiary obligation of the Contractor cover under the other contract items.

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.

ASTM International (ASTM)

ASTM D2995	Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors
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ASTM D3628	Standard Practice for Selection and Use of Emulsified Asphalts
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END OF ITEM P-602

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Item P-603 Emulsified Asphalt Tack Coat

DESCRIPTION

603-1.1 This item shall consist of preparing and treating an asphalt or concrete surface with asphalt material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

603-2.1 Asphalt materials. The asphalt material shall be an emulsified asphalt as specified in ASTM D3628 as an asphalt application for tack coat appropriate to local conditions. The emulsified asphalt shall not be diluted. The Contractor shall provide a copy of the manufacturer's Certificate of Analysis (COA) for the asphalt material to the Resident Project Representative (RPR) before the asphalt material is applied for review and acceptance. The furnishing of COA for the asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

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 RPR.

603-3.2 Equipment. The Contractor shall provide equipment for heating and applying the emulsified asphalt material. The emulsion shall be applied with a manufacturer-approved computer rate-controlled asphalt distributor. The equipment shall be in good working order and contain no contaminants or diluents in the tank. Spray bar tips must be clean, free of burrs, and of a size to maintain an even distribution of the emulsion. Any type of tip or pressure source is suitable that will maintain predetermined flow rates and constant pressure during the application process with application speeds under eight (8) miles per hour (13 km per hour) or seven (700) feet per minute (213 m per minute).

The equipment will be tested under pressure for leaks and to ensure proper set-up before use to verify truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application, spray-bar height and pressure and pump speed, evidence of triple-overlap spray pattern, lack of leaks, and any other factors relevant to ensure the truck is in good working order before use.

The distributor truck shall be equipped with a minimum 12-foot (3.7-m) spreader spray bar with individual nozzle control with computer-controlled application rates. The distributor truck shall have an easily accessible thermometer that constantly monitors the temperature of the emulsion, and have an operable mechanical tank gauge that can be used to cross-check the computer accuracy. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

The distributor truck shall be equipped to effectively heat and mix the material to the required temperature prior to application as required. Heating and mixing shall be done in accordance with the manufacturer's recommendations. Do not overheat or over mix the material.

The distributor shall be equipped with a hand sprayer.

Asphalt distributors must be calibrated annually in accordance with ASTM D2995. The Contractor must furnish a current calibration certification for the asphalt distributor truck from any State or other agency as approved by the RPR.

A power broom and/or power blower suitable for cleaning the surfaces to which the asphalt tack coat is to be applied shall be provided.

603-3.3 Application of emulsified asphalt material. The emulsified asphalt shall not be diluted. Immediately before applying the emulsified asphalt 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.

The emulsified asphalt material shall be uniformly applied with an asphalt distributor at the rates appropriate for the conditions and surface specified in the table below. The type of asphalt material and application rate shall be approved by the RPR prior to application.

Emulsified Asphalt

Surface Type	Residual Rate, gal/SY (L/square meter)	Emulsion Application Bar Rate, gal/SY (L/square meter)
New asphalt	0.02-0.05 (0.09-0.23)	0.03-0.07 (0.13-0.32)
Existing asphalt	0.04-0.07 (0.18-0.32)	0.06-0.11 (0.27-0.50)
Milled Surface	0.04-0.08 (0.18-0.36)	.06-0.12 (0.27-0.54)
Concrete	0.03-0.05 (0.13-0.23)	0.05-0.08 (0.23-0.36)

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 RPR. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed. When the tack coat has been disturbed by the Contractor, tack coat shall be reapplied at the Contractor's expense.

603-3.4 Freight and waybills The Contractor shall submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt 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 AND BASIS OF PAYMENT

603-4.1 No separate measurement or payment shall be made for emulsified asphalt tack coat; it shall be considered a subsidiary obligation of the Contractor cover under the other contract items.

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.

ASTM International (ASTM)

ASTM D1250 Standard Guide for Use of the Petroleum Measurement Tables

ASTM D2995 Standard Practice for Estimating Application Rate and Residual Application Rate
of Bituminous Distributors

ASTM D3628 Standard Practice for Selection and Use of Emulsified Asphalts

END ITEM P-603

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Item P-610 Structural Portland Cement Concrete

DESCRIPTION

610-1.1 This item shall consist of plain and/or reinforced structural portland cement concrete (PCC), prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans. This specification shall be used for all structural and miscellaneous concrete including signage bases.

MATERIALS

610-2.1 General. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. Materials may be subject to inspection and tests at any time during their preparation or use. The source of all materials shall be approved by the Engineer before delivery or use in the work. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to ensure preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed in them.

The use of pit-run aggregates shall not be permitted unless the pit-run aggregate has been screened and washed, and all fine and coarse aggregates stored separately and kept clean. The mixing of different aggregates from different sources in one storage stockpile or alternating batches of different aggregates shall not be permitted.

a. Reactivity. Fine and Coarse aggregates to be used in all concrete shall be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and C1567. Aggregate and mix proportion reactivity tests shall be performed for each project.

(1) Coarse and fine aggregate shall be tested separately in accordance with ASTM C1260. The aggregate shall be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.10% at 28 days (30 days from casting).

(2) Combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) CRD C662. If lithium nitrate admixture is used, it shall be nominal 30% $\pm$ 0.5% weight lithium nitrate in water.

(3) If the expansion of the proposed combined materials test specimens, tested in accordance with ASTM C1567, modified for combined aggregates, or COE CRD C662, does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion of the proposed combined materials test specimens is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

610-2.2 Coarse aggregate. The coarse aggregate for concrete shall meet the requirements of ASTM C33. The Engineer may consider and reserve final approval of other State classification procedures addressing aggregate durability.

Coarse aggregate shall be well graded from coarse to fine and shall meet the following gradation shown in the table below when tested per ASTM C136.

Gradation For Coarse Aggregate

Sieve Designation (square openings)	Percentage by Weight Passing Sieves						
	2" (50 mm)	1-1/2" (38 mm)	1" (25 mm)	3/4" (19 mm)	1/2" (12 mm)	3/8" (9 mm)	No. 4
No. 4 to 3/4 in. (4.75-19 mm)			100	90-100		20-55	0-10
No. 4 to 1 in. (4.75-25 mm)		100	90-100		25-60		0-10
No. 4 to 1-1/2 in. (4.75-38 mm)	100	95-100		35-70		10-30	0-5

610-2.2.1 Aggregate susceptibility to durability (D) cracking. Aggregates that have a history of D-cracking shall not be used. Coarse aggregate may be accepted from sources that have a 20-year service history for the same gradation to be supplied with no durability issues.

a. Material currently being produced shall have a durability factor ≥ 95 using ASTM C666. Coarse aggregates that are crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite or trap rock are considered to meet the D-cracking test but must meet all other quality tests. Aggregates meeting State Highway Department material specifications may be acceptable with concurrence of the FAA.

b. The Contractor shall submit a current certification that the aggregate does not have a history of D-cracking and that the aggregate meets the state specifications for use in PCC pavement for use on interstate highways. Certifications, tests and any history reports must be for the same gradation as being proposed for use on the project. Certifications which are not dated, or which are over one (1) year old or which are for different gradations will not be accepted. Test results will only be accepted when tests were performed by a State Department of Transportation (DOT) materials laboratory or an accredited laboratory.

610-2.3 Fine aggregate. The fine aggregate for concrete shall meet the requirements of ASTM C33.

The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of the table below when tested in accordance with ASTM C136:

Gradation For Fine Aggregate

Sieve Designation (square openings)	Percentage by Weight Passing Sieves
3/8 inch (9 mm)	100
No. 4 (4.75 mm)	95-100
No. 16 (1.18 mm)	45-80
No. 30 (0.60 mm)	25-55
No. 50 (0.30 mm)	10-30
No. 100 (0.15 mm)	2-10

Blending will be permitted, if necessary, to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, if the deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials

other than Portland cement, as specified in paragraph 610-2.6, Admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

610-2.4 Cement. Cement shall conform to the requirements of ASTM C150 Type II.

If aggregates are deemed innocuous when tested in accordance with paragraph 610-2.1.a.1 and accepted in accordance with paragraph 610-2.1.a.3, higher equivalent alkali content in the cement may be allowed if approved by the Engineer and FAA. If cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

The Contractor shall furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. The report shall be delivered to the Engineer before use of the cement is granted. All test reports shall be subject to verification by testing sample materials received for use on the project.

610-2.5 Water. The water used in concrete shall be fresh, clean and potable; free from injurious amounts of oils, acids, alkalies, salts, organic materials or other substances deleterious to concrete.

610-2.6 Admixtures and supplementary cementitious material. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

a. Air-entraining admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.

b. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D. ASTM C494, Type F and G high range water reducing admixtures and ASTM C1017 flowable admixtures shall not be used.

c. Other chemical admixtures. The use of set retarding, and set-accelerating admixtures shall be approved by the Engineer. Retarding shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

d. Lithium nitrate. The lithium admixture shall be a nominal 30% aqueous solution of Lithium Nitrate, with a density of 10 pounds/gallon (1.2 kg/L), and shall have the approximate chemical form as shown below:

<u>Constituent</u>	<u>Limit (Percent by Mass)</u>
LiNO ₃ (Lithium Nitrate)	30 ±0.5
SO ₄ (Sulfate Ion)	0.1 (max)
Cl (Chloride Ion)	0.2 (max)
Na (Sodium Ion)	0.1 (max)
K (Potassium Ion)	0.1 (max)

Provide a trained representative to supervise the lithium nitrate admixture dispensing and mixing operations.

e. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash for use in mitigating alkali-silica reactivity shall have a Calcium Oxide (CaO) content of less than 13%.

610-2.7 Premolded joint material. Premolded joint material for expansion joints shall meet the requirements of ASTM D1751.

610-2.8 Joint filler. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified.

610-2.9 Steel reinforcement. Reinforcing shall be as indicated on the plans. Reinforcing shall meet the following requirements: Reinforcing Steel (ASTM A615, ASTM A706, ASTM A775, ASTM A934), Welded Steel Wire Fabric (ASTM A1064), Welded Deformed Steel Fabric (ASTM A1064), or Bart Mats (ASTM A184 or ASTM A704).

610-2.10 Materials for curing concrete. Curing materials shall conform to one or more of the following:

Waterproof paper	ASTM C171
Clear or white Polyethylene Sheeting	ASTM C171
White-pigmented Liquid Membrane-Forming Compound, Type 2, Class B	ASTM C309

CONSTRUCTION METHODS

610-3.1 General. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified here. All machinery and equipment used by the Contractor on the work, shall be of sufficient size to meet the requirements of the work. All work shall be subject to the inspection and approval of the Engineer.

610-3.2 Concrete composition. The concrete shall develop the required compressive strength in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cement per cubic yard (280 kg per cubic meter). The concrete shall contain 5% of entrained air, $\pm 1\%$, as determined by ASTM C231 and shall have a slump of not more than 4 inches (100 mm) as determined by ASTM C143.

610-3.3 Acceptance sampling and testing. Concrete for each structure will be accepted on the basis of the compressive strength specified in paragraph 610-3.2. The concrete shall be sampled in accordance with ASTM C172. Concrete cylindrical compressive strength specimens shall be made in accordance with ASTM C31 and tested in accordance with ASTM C39. The Contractor shall cure and store the test specimens under such conditions as directed by the Engineer. The Engineer will make the actual tests on the specimens at no expense to the Contractor.

610-3.4 Qualifications for concrete testing service. Perform concrete testing by an approved laboratory and inspection service experienced in sampling and testing concrete. Testing agency must meet the requirements of ASTM C1077 or ASTM E329.

610-3.5 Proportioning and measuring devices. When package cement is used, the quantity for each batch shall be equal to one or more whole sacks of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment. Weighing boxes or hoppers shall be approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so the required, exact weight of aggregates is obtained.

610-3.6 Consistency. The consistency of the concrete shall be determined by the slump test specified in ASTM C143.

610-3.7 Mixing. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C94.

610-3.8 Mixing conditions. The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F (4°C) without permission of the Engineer. If permission is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F (10°C) nor more than 100°F (38°C). The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his expense.

Retempering of concrete by adding water or any other material shall not be permitted.

The rate of delivery of concrete to the job shall be sufficient to allow uninterrupted placement of the concrete.

610-3.9 Forms. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the Engineer. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as shown on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes. The Contractor shall be responsible for their adequacy.

The internal form ties shall be arranged so no metal will show in the concrete surface or discolor the surface when exposed to weathering when the forms are removed. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied immediately before the concrete is placed. Forms shall be constructed so they can be removed without injuring the concrete or concrete surface. The forms shall not be removed until at least 30 hours after concrete placement for vertical faces, walls, slender columns, and similar structures. Forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate the concrete has developed at least 60% of the design strength.

610-3.10 Placing reinforcement. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concrete placement. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.11 Embedded items. Before placing concrete, all embedded items shall be firmly and securely fastened in place as indicated. All embedded items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The concrete shall be spaded and consolidated around and against embedded items. The embedding of wood shall not be allowed.

610-3.12 Placing concrete. All concrete shall be placed during daylight hours, unless otherwise approved. The concrete shall not be placed until the depth and condition of foundations, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the Engineer. Concrete shall be placed as soon as practical after mixing, but in no case later than one (1) hour after water has been added to the mix. The method and manner of placing shall avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. The concrete shall not be dropped from a height of more than 5 feet (1.5 m). Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation. Concrete shall be placed on clean, damp surfaces, free from running water, or on a properly consolidated soil foundation.

610-3.13 Vibration. Vibration shall follow the guidelines in American Concrete Institute (ACI) Committee 309, Guide for Consolidation of Concrete. Where bars meeting ASTM A775 or A934 are used, the vibrators shall be equipped with rubber or non-metallic vibrator heads. Furnish a spare, working, vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches (100 mm) in depth with high frequency mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches (100 mm) or less in depth by wood tampers, spading, and

settling with a heavy leveling straightedge. Operate internal vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 cycles per minute when submerged. Do not use vibrators to transport the concrete in the forms. Penetrate the previously placed lift with the vibrator when more than one lift is required. Use external vibrators on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete. Vibrators shall be manipulated to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any point shall be of sufficient duration to accomplish compaction but shall not be prolonged to where segregation occurs. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie or other approved method and shall not be disturbed after placement.

610-3.14 Construction joints. If the placement of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, provisions shall be made for grooves, steps, reinforcing bars or other devices as specified. The work shall be arranged so that a section begun on any day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete that has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

610-3.15 Expansion joints. Expansion joints shall be constructed at such points and dimensions as indicated on the drawings. The premolded filler shall be cut to the same shape as the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place so that it will not be displaced when concrete is deposited against it.

610-3.16 Defective work. Any defective work discovered after the forms have been removed, which in the opinion of the Engineer cannot be repaired satisfactorily, shall be immediately removed and replaced at the expense of the Contractor. Defective work shall include deficient dimensions, or bulged, uneven, or honeycomb on the surface of the concrete.

610-3.17 Surface finish. All exposed concrete surfaces shall be true, smooth, and free from open or rough areas, depressions, or projections. All concrete horizontal plane surfaces shall be brought flush to the proper elevation with the finished top surface struck-off with a straightedge and floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

The surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall be wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface. When approved, the finishing can be done with a finishing machine.

610-3.18 Curing and protection. All concrete shall be properly cured and protected by the Contractor. The concrete shall be protected from the weather, flowing water, and from defacement of any nature during the project. The concrete shall be cured by covering with an approved material as soon as it has sufficiently hardened. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for at least three (3) days following concrete placement. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to air currents. Wooden forms shall be kept wet at all times until removed to prevent opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for seven (7) days after the concrete has been placed.

610-3.19 Drains or ducts. Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

610-3.20 Cold weather placing. When concrete is placed at temperatures below 40°F (4°C), the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, shall be heated to place the concrete at temperatures between 50°F and 100°F (10°C and 38°C).

Calcium chloride may be incorporated in the mixing water when directed by the Engineer. Not more than pounds (908 grams) of Type 1 nor more than 1.6 pounds (726 grams) of Type 2 shall be added per bag of cement. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50°F (10°C) until at least 60% of the designed strength has been attained.

610-3.21 Hot weather placing. Concrete shall be properly placed and finished with procedures previously submitted. The concrete-placing temperature shall not exceed 90°F (32°C) when measured in accordance with ASTM C1064. Cooling of the mixing water and aggregates, or both, may be required to obtain an adequate placing temperature. A retarder meeting the requirements of paragraph 610-2.6 may be used to facilitate placing and finishing. Steel forms and reinforcement shall be cooled prior to concrete placement when steel temperatures are greater than 120°F (50°C). Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature. Submit the proposed materials and methods for review and approval by the Engineer, if concrete is to be placed under hot weather conditions.

610-3.22 Filling joints. All joints that require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools. Joint filling shall not start until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be done with proper equipment to obtain a neat looking joint free from excess filler.

METHOD OF MEASUREMENT

610-4. No separate measurement shall be made for structural Portland Cement Concrete.

BASIS OF PAYMENT

610-5.1 No separate payment shall be made for this item. Portland Cement Concrete shall be included in the unit cost of the item to which it pertains.

TESTING REQUIREMENTS

ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregates (Accelerated Mortar-Bar Method)
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
U.S. Army Corps of Engineers (USACE) Concrete Research Division (CRD) C662	Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

MATERIAL REQUIREMENTS

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704	Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete

ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete

END OF ITEM P-610

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Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the Resident Project Representative (RPR). The terms “paint” and “marking material” as well as “painting” and “application of markings” are interchangeable throughout this specification. **All permanent apron and taxiway markings shall receive two coats of paint.**

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. This certification along with a copy of the paint manufacturer’s surface preparation; marking materials, including adhesion, flow promoting and/or floatation additive; and application requirements must be submitted and approved by the Resident Project Representative (RPR) prior to the initial application of markings. The reports can be used for material acceptance or the RPR may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the RPR upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers that are easily quantifiable for inspection by the RPR.

620-2.2 Marking materials.

Table 1. Marking Materials

Paint ¹				Glass Beads ²	
Type	Color	Fed Std. 595 Number	Application Rate Maximum	Type	Application Rate Minimum
I	Yellow	33538 or 33655	115 ft ² /gal (2.8 m ² /l)	Type I, Gradation A	7 lb./gal (0.85 kg/l)
I	Black	37038	115 ft ² /gal (2.8 m ² /l)	Type I, Gradation A	N/A

a. Paint. Paint shall be waterborne in accordance with the requirements of this paragraph. Paint colors shall comply with Federal Standard No. 595.

Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952F, Type I. 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.

b. Reflective media. Glass beads for white and yellow paint shall meet the requirements for Federal Specification TT-B-1325D Type I, Gradation A.

Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

Glass beads shall not be used in black paint.

CONSTRUCTION METHODS

620-3.1 Weather limitations. Painting shall only be performed when the surface is dry, and the ambient temperature and the pavement surface temperature meet the manufacturer's recommendations in accordance with subsection 620-2.1. Painting operations shall be discontinued when the ambient or surface temperatures does not meet the manufacturer's recommendations. Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns. Markings shall not be applied when weather conditions are forecasts to not be within the manufacturers' recommendations for application and dry time.

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 with automatic glass bead dispensers suitable for application of traffic paint. It shall produce an even and uniform film thickness and appearance of both paint and glass beads at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray. The marking equipment for both paint and beads shall be calibrated daily.

620-3.3 Preparation of surfaces. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other contaminants that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the RPR. 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.

a. Preparation of new pavement surfaces. The area to be painted shall be cleaned by broom, blower, water blasting, or by other methods approved by the RPR to remove all contaminants, including PCC curing compounds, minimizing damage to the pavement surface.

b. Preparation of pavement to remove existing markings. Existing pavement markings shall be removed by rotary grinding, water blasting, or by other methods approved by the RPR minimizing damage to the pavement surface. The removal area may need to be larger than the area of the markings to eliminate ghost markings. After removal of markings on asphalt pavements, apply a fog seal or seal coat to 'block out' the removal area to eliminate 'ghost' markings.

c. Preparation of pavement markings prior to remarking. Prior to remarking existing markings, loose existing markings must be removed minimizing damage to the pavement surface, with a method approved by the RPR. After removal, the surface shall be cleaned of all residue or debris.

Prior to the application of markings, the Contractor shall certify in writing that the surface is dry and free from dirt, grease, oil, laitance, or other foreign material that would prevent the bond of the paint to the pavement or existing markings. This certification along with a copy of the paint manufactures application and surface preparation requirements must be submitted to the RPR 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. The locations of markings to receive glass beads shall be shown on the plans.

620-3.5 Application. A period of 30 days shall elapse between placement of surface course or seal coat and application of the final coat of permanent paint markings. 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 RPR.

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 spacing shall be within the following tolerances:

Marking Dimensions and Spacing Tolerance

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.

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of each coat 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 and distribution should be performed.

620-3.6 Application--preformed thermoplastic airport pavement markings.

Preformed thermoplastic pavement markings not used.

620-3.7 Control strip. Prior to the full application of airfield markings, the Contractor shall prepare a control strip in the presence of the RPR. The Contractor shall demonstrate the surface preparation method and all striping equipment to be used on the project. The marking equipment must achieve the prescribed application rate of paint and population of glass beads (per Table 1) that are properly embedded and evenly distributed across the full width of the marking. Prior to acceptance of the control strip, markings must be evaluated during darkness to ensure a uniform appearance.

620-3.8 Retro-reflectance. Reflectance shall be measured with a portable retro-reflectometer meeting ASTM E1710 (or equivalent). A total of 6 reading shall be taken over a 6 square foot area with 3 readings taken from each direction. The average shall be equal to or above the minimum levels of all readings which are within 30% of each other.

Minimum Retro-Reflectance Values

Material	Retro-reflectance mcd/m ² /lux		
	White	Yellow	Red
Initial Type I	300	175	35
Initial Type III	600	300	35
Initial Thermoplastic	225	100	35
All materials, remark when less than ¹	100	75	10

¹ Prior to remarking determine if removal of contaminants on markings will restore retro-reflectance

620-3.9 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 reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the RPR. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes and regulations.

620-3.10 Paint Removal. Existing paint removal shall be accomplished by the methods described in Section 620-3.3.b.

METHOD OF MEASUREMENT

620-4.1 The quantity of Permanent Reflective and Non-Reflective airfield pavement markings to be paid for shall be the number of square feet (square meters) for each coat of painting performed in accordance with the specifications and accepted by the Engineer.

No separate measurement or payment shall be made for the glass beads, they shall be considered a subsidiary obligation of the contractor covered under this contract item.

620-4.2 The quantity of "Remove Existing Pavement Markings" to be paid for shall be the number of square feet (square meters).

BASIS OF PAYMENT

620-5.1 Payment shall be made at the respective contract price per square foot (square meter) for Permanent Reflective and Non-Reflective Airfield Pavement Markings. This price shall be full compensation for furnishing all materials including reflective media and for all labor, equipment, tools, and incidentals necessary to complete the item.

620-5.2 Payment for "Remove Existing Pavement Markings" shall be made at the contract price per square foot (square meter) which price shall be full compensation for furnishing all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

- Item P-620-1 Permanent Reflective Airfield Pavement Markings - per square foot (square meter)
- Item P-620-2 Remove Existing Pavement Markings - per square foot (square meter)

TESTING REQUIREMENTS

ASTM C371	Standard Test Method for Wire-Cloth Sieve Analysis of Nonplastic Ceramic Powders
ASTM D92	Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
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
AC 150/5340-1

Colors used in Government Procurement
Standards for Airport Markings

END OF ITEM P-620

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Part 11 – Drainage

Item D-701 Pipe for Storm Drains and Culverts

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below. Underground piping and components used in drainage systems for terminal and aircraft fueling ramp drainage shall be noncombustible and inert to fuel in accordance with National Fire Protection Association (NFPA) 415.

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 American Association of State Highway and Transportation Officials (AASHTO) requirements:

AASHTO R73	Standard Practice for Evaluation of Precast Concrete Drainage Productions
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C1479	Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
ASTM C1840	Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe

701-2.3 Concrete. Concrete for pipe cradles shall have a minimum compressive strength of 2000 psi (13.8 MPa) at 28 days and conform to the requirements of ASTM C94.

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.

701-2.5 Joint mortar. Pipe joint mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

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 ASTM C990.

701-2.9 Precast box culverts. Manufactured in accordance with and conforming to ASTM C1433.

701-2.10 Precast concrete pipe. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification program.

CONSTRUCTION METHODS

701-3.1 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 12 inches (300 mm) on each side. The trench walls shall be approximately vertical.

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.

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) or 1/2 inch (12 mm) for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The excavation below grade should be filled with granular material to form a uniform foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The RPR shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

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.

701-3.2 Bedding. The bedding surface for the pipe shall provide a foundation of uniform density to support the pipe throughout its entire length.

a. Rigid pipe. The pipe bedding shall be constructed uniformly for the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 in when the bedding thickness is less than 6 inches, and 1-1/2 in when the bedding thickness is greater than 6 inches. Bedding shall be loosely placed uncompacted material under the middle third of the pipe prior to placement of the pipe.

b. Flexible pipe. For flexible pipe, the bed shall be roughly shaped to fit the pipe, and a bedding blanket of sand or fine granular material shall be provided as follows:

Flexible Pipe Bedding

Pipe Corrugation Depth		Minimum Bedding Depth	
inch	mm	inch	mm
1/2	12	1	25
1	25	2	50
2	50	3	75
2-1/2	60	3-1/2	90

c. Other pipe materials. For PVC, polyethylene, polypropylene, or fiberglass pipe, the bedding material shall consist of coarse sands and gravels with a maximum particle size of 3/4 inches (19 mm). For pipes installed under paved areas, no more than 12% of the material shall pass the No. 200 (0.075 mm) sieve. For all other areas, no more than 50% of the material shall pass the No. 200 (0.075 mm) sieve. The bedding shall have a thickness of at least 6 inches (150 mm) below the bottom of the pipe and extend up around the pipe for a depth of not less than 50% of the pipe's vertical outside diameter.

701-3.3 Laying pipe. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced 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. Joints shall be made with (1) cement mortar, (2) cement grout, (3) rubber gaskets, (4) plastic gaskets or (5) coupling bands.

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

a. Concrete pipe. Concrete pipe may be either bell and spigot or tongue and groove. Pipe sections at joints shall be fully seated and the inner surfaces flush and even. Concrete pipe joints shall be sealed with rubber gaskets meeting ASTM C443 when leak resistant joints are required.

b. Metal pipe. Not used.

c. PVC, Polyethylene, or Polypropylene pipe. Not used.

d. Fiberglass pipe. Not used.

701-3.5 Embedment and Overfill. Pipes shall be inspected before any fill material is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense.

701-3.5-1 Embedment Material Requirements

a. Concrete Pipe. Embedment material and compaction requirements shall be in accordance with the applicable Type of Standard Installation (Types 1, 2, 3, or 4) per ASTM C1479. If a concrete cradle or CLSM embedment material is used, it shall conform to the plan details.

b. Plastic and fiberglass Pipe. Embedment material shall meet the requirements of ASTM D3282, A-1, A-2-4, A-2-5, or A-3. Embedment material shall be free of organic material, stones larger than 1.5 inches in the greatest dimension, or frozen lumps. Embedment material shall extend to 12 inches above the top of the pipe.

c. Metal Pipe. Embedment material shall be granular as specified in the contract document and specifications, and shall be free of organic material, rock fragments larger than 1.5 inches in the greatest dimension and frozen lumps. As a minimum, backfill materials shall meet the requirements of ASTM D3282, A-1, A-2, or A-3. Embedment material shall extend to 12 inches above the top of the pipe.

701-3.5-2 Placement of Embedment Material

The embedment material shall be compacted in layers not exceeding 6 inches (150 mm) on each side of the pipe and shall be brought up one foot (30 cm) above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the embedment material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the embedment material shall be compacted in layers not exceeding 6 inches (150 mm) and shall be brought up evenly on each side of the pipe to one foot (30 cm) above the top of the pipe. All embedment material shall be compacted to a density required under Item P-152.

Concrete cradles and flowable fills, such as controlled low strength material (CLSM) or controlled density fill (CDF), may be used for embedment provided adequate flotation resistance can be achieved by restraints, weighing, or placement technique.

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 Overfill

Pipes shall be inspected before any overfill is in place. Any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense. Evaluation of any damage to RCP shall be evaluated based on AASHTO R73.

Overfill material shall be placed and compacted in layers as required to achieve compaction to at least 95 percent standard proctor per ASTM D698. The soil shall contain no debris, organic matter, frozen material, or stones with a diameter greater than one half the thickness of the compacted layers being placed.

701-3.7 Inspection Requirements

An initial post installation inspection shall be performed by the RPR no sooner than 30 days after completion of installation and final backfill. Clean or flush all lines prior to inspection.

Use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe interior. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe.

Incorporate specific inspection requirements for the various types of pipes beneath the general inspection requirements.

Reinforced concrete pipe shall be inspected, evaluated, and reported on in accordance with ASTM C1840, "Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe." Any issues reported shall include still photo and video documentation. The zoom ratio shall be provided for all still or video images that document any issues of concern by the inspection firm.

METHOD OF MEASUREMENT

701-4.1 The length of pipe shall be measured in linear feet (m) of pipe in place, completed, and accepted. 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. Each class, type, and size of pipe shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipe being measured. There shall be no separate measurement for bedding, embedment, and backfill as indicated in the plans.

Flared End Sections shall be measured per each in place, completed, and approved.

BASIS OF PAYMENT

701-5.0 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. There shall be no separate payment for riprap, bedding, embedment, and backfill as indicated in the plans.

Payment will be made at the contract unit price per linear foot (meter) for each class, type, and size of pipe and per each Flared End Section.

No additional payment will be made for connecting existing and new pipes together, connecting a new pipe to another new pipe, or providing bends to make connections.

Payment will be made under:

Item D-701-1	Install 18 inch Pipe (Reinforced Concrete Class IV) - per linear foot (meter)
Item D-701-2	Install 24 inch Pipe (Reinforced Concrete Class IV) - per linear foot (meter)
Item D-701-3	Install 18 inch Flared End Section (Precast Concrete) with Riprap - per each
Item D-701-4	Install 24 inch Flared End Section (Precast Concrete) with Riprap - per each

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.

American Association of State Highway and Transportation Officials (AASHTO)

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 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 International (ASTM)	
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 C990	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
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 D3262	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Sewer Pipe
ASTM D3282	Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
ASTM D4161	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Pipe Joints 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
National Fire Protection Association (NFPA)	
NFPA 415	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways

END ITEM D-701

Item D-751 Manholes, Catch Basins, Inlets and Inspection Holes

DESCRIPTION

751-1.1 This item shall consist of construction of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the RPR.

MATERIALS

751-2.1 Brick. The brick shall conform to the requirements of ASTM C32, Grade MS.

751-2.2 Mortar. Mortar shall consist of one part Portland cement and two parts sand. The cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

751-2.3 Concrete. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item P-610.

751-2.4 Precast concrete pipe manhole rings. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches (90 cm) nor more than 48 inches (120 cm). There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole. Gaskets shall conform to the requirements of ASTM C443.

751-2.5 Corrugated metal. Corrugated metal shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M36.

751-2.6 Frames, covers, and grates. The castings shall conform to one of the following requirements:

- a. ASTM A48, Class 35B: Gray iron castings
- b. ASTM A47: Malleable iron castings
- c. ASTM A27: Steel castings
- d. ASTM A283, Grade D: Structural steel for grates and frames
- e. ASTM A536, Grade 65-45-12: Ductile iron castings
- f. ASTM A897: Austempered ductile iron castings

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

751-2.7 Steps. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of asphalt paint, when directed.

751-2.8 Precast inlet structures. Manufactured in accordance with and conforming to ASTM C913.

CONSTRUCTION METHODS

751-3.1 Unclassified excavation.

a. The Contractor shall excavate for structures and footings to the lines and grades or elevations, shown on the plans, or as staked by the RPR. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the RPR may direct, in writing, changes in dimensions or elevations of footings necessary for a satisfactory foundation.

b. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the RPR. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. Where concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing is placed.

c. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

d. All bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage finished masonry. The cost of removal shall be included in the unit price bid for the structure.

e. After excavation is completed for each structure, the Contractor shall notify the RPR. No concrete or reinforcing steel shall be placed until the RPR has approved the depth of the excavation and the character of the foundation material.

751-3.2 Brick structures.

a. Foundations. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of reinforced concrete mixed, prepared, and placed in accordance with the requirements of Item P-610.

b. Laying brick. All brick shall be clean and thoroughly wet before laying so that they will not absorb any appreciable amount of additional water at the time they are laid. All brick shall be laid in freshly made mortar. Mortar not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted. An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it that can be readily closed by the laying of the brick. All bed and head joints shall be filled solid with mortar. End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint. Any bricks that may be loosened after the mortar has taken its set, shall be removed, cleaned, and re-laid with fresh mortar. No broken or chipped brick shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges; in which case, full bricks shall be placed at ends or corners where possible, and the bats shall be used in the interior of the course. In making closures, no piece of brick shorter than the width of a whole brick shall be used; and wherever practicable, whole brick shall be used and laid as headers.

c. Joints. All joints shall be filled with mortar at every course. Exterior faces shall be laid up in advance of backing. Exterior faces shall be plastered or parged with a coat of mortar not less than 3/8 inch (9 mm) thick before the backing is laid up. Prior to parging, all joints on the back of face courses shall be

cut flush. Unless otherwise noted, joints shall be not less than 1/4 inch (6 mm) nor more than 1/2 inch (12 mm) wide and the selected joint width shall be maintained uniform throughout the work.

d. Pointing. Face joints shall be neatly struck, using the weather-struck joint. All joints shall be finished properly as the laying of the brick progresses. When nails or line pins are used, the holes shall be immediately plugged with mortar and pointed when the nail or pin is removed.

e. Cleaning. Upon completion of the work all exterior surfaces shall be thoroughly cleaned by scrubbing and washing with water. If necessary to produce satisfactory results, cleaning shall be done with a 5% solution of muriatic acid which shall then be rinsed off with liberal quantities of water.

f. Curing and cold weather protection. The brick masonry shall be protected and kept moist for at least 48 hours after laying the brick. Brick masonry work or pointing shall not be done when there is frost on the brick or when the air temperature is below 50°F (10°C) unless the Contractor has, on the project ready to use, suitable covering and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 60°F (16°C) for the duration of the curing period.

751-3.3 Concrete structures. Concrete structures which are to be cast-in-place within the project boundaries shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the RPR before the concrete is placed.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped to the outlet.

751-3.4 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program.

Precast concrete structures shall conform to ASTM C478. Precast concrete structures shall be constructed on prepared or previously placed slab foundations conforming to the dimensions and locations shown on the plans. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall: (1) be smoothed to a uniform surface on both interior and exterior of the structure or (2) utilize a rubber gasket per ASTM C443. The top of the upper precast concrete section shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal or metal encapsulated steps that are embedded or built into the side walls shall be aligned and placed in accordance to ASTM C478. When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 Corrugated metal structures. Corrugated metal structures shall be prefabricated. All standard or special fittings shall be furnished to provide pipe connections or branches with the correct dimensions and of sufficient length to accommodate connecting bands. The fittings shall be welded in place to the metal structures. The top of the metal structure shall be designed so that either a concrete slab or metal collar may be attached to allow the fastening of a standard metal frame and grate or cover. Steps or ladders shall be furnished as shown on the plans. Corrugated metal structures shall be constructed on prepared foundations, conforming to the dimensions and locations as shown on the plans. When indicated, the structures shall be placed on a reinforced concrete base.

751-3.6 Inlet and outlet pipes. Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections. They shall be cut off flush with

the wall on the inside surface of the structure, unless otherwise directed. For concrete or brick structures, mortar shall be placed around these pipes to form a tight, neat connection.

751-3.7 Placement and treatment of castings, frames, and fittings. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the RPR, and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are placed on previously constructed masonry, the bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface so the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed by the RPR. All units shall set firm and secure.

After the frames or fittings have been set in final position, the concrete or mortar shall be allowed to harden for seven (7) days before the grates or covers are placed and fastened down.

751-3.8 Installation of steps. The steps shall be installed as indicated on the plans or as directed by the RPR. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least seven (7) days. After seven (7) days, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete structures they shall meet the requirements of ASTM C478. The steps shall be cast into the side of the sections at the time the sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches (300 mm).

Instead of steps, prefabricated ladders may be installed. For brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. For metal structures, the ladder shall be secured by welding the top support to the structure and grouting the bottom support into drilled holes in the foundation or as directed by the RPR.

751-3.9 Backfilling.

a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches (200 mm) in loose depth, and compacted to the density required in Item P-152. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

b. Backfill shall not be placed against any structure until approved by the RPR. For concrete structures, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill and placing methods.

c. Backfill shall not be measured for direct payment. Performance of this work shall be considered an obligation of the Contractor covered under the contract unit price for the structure involved.

751-3.10 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as approved by the RPR. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 Install 24"x36" Catch Basin shall be measured by each structure completed and accepted.

BASIS OF PAYMENT

751-5.1 The accepted quantities of installation of catch basins will be paid for at the contract unit price per each in place completed and accepted. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor equipment, tools and incidentals necessary to complete the structure. There will be no separate payment for concrete structure surrounds/collars at the ground surface. There will be no separate payment for asphalt patches required for installation of manhole adjustments, catch basins, manholes, inlets, cleanouts, or valve covers adjacent to existing pavement to remain. Existing and proposed pipe connections and pipe lengths necessary to make connections to manhole and catch basin structures and pipe lengths necessary to patch existing pipe penetrations to be removed shall be incidental with no separate measurement or payment.

Payment will be made under:

Item D-751-1 Install 24" x 36" Catch Basin - per each

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.

ASTM International (ASTM)

ASTM A27	Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A897	Standard Specification for Austempered Ductile Iron Castings
ASTM C32	Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
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 C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C913	Standard Specification for Precast Concrete Water and Wastewater Structures.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M36 Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers
and Drains

END OF ITEM D-751

Part 13 – Lighting Installation

Item L-100 Electrical General Requirements

DESCRIPTION

100-1.1 GENERAL. This Item includes the removal and if needed the reinstallation of all material, equipment and apparatus, and all labor, tools, services and equipment required for the following:

- a. The demolition and salvage/removal of portions of the existing airfield lighting systems.

Installation shall be in accordance with Specifications FAA-C-1217 and FAA-C-1391 (current editions), except as specified herein. Perform all work not included in the FAA Specifications in accordance with the National Electrical Code, applicable local and Weed Airport standards and regulations.

100-1.2 DEMOLITION.

- a. Demolition (removal and non-salvage to Owner or for re-installation) of other airfield electrical system elements shall include the intent, but not be limited to the specific elements, of the following:

- (1) Quartz lamp type lights.
- (2) Retroreflective markers.
- (3) Power and signal cables.

- b. Demolition (removal and non-salvage) of other elements associated with the airfield electrical system is included under other Items of this project (Item P-151 “Removal of Existing Facilities (Clearing)”). Elements covered shall include the intent, but not be limited to the specific elements, of the following:

- (1) Underground conduits and duct banks, both concrete encased and direct earth buried.
- (2) Underground electrical concrete structures including manholes and handholes of varying sizes.
- (3) Light concrete encased bases and miscellaneous concrete footings.
- (4) Grading and backfill associated with removal of the foregoing elements shall be covered under other Items of these specifications (P-152, “Excavation and Embankment”).

100-1.3 RELATED DOCUMENTS. The General Provisions of the Contract, including General and Special Conditions, apply to work specified in this Item.

- a. See General Conditions for liquidated damages.

- b. See Item P-151 “Removal of Existing Facilities (Clearing)” for specifics of demolition and adjustment of existing facilities.

100-1.4 CONSTRUCTION DOCUMENTS COORDINATION. Contractor coordination of Construction Documents (plans, details, specifications, etc.) shall meet the following:

- a. Drawings and Specifications are complementary: Work, material or requirements called for by either one is binding as if called for by both.
- b. Notification of the Engineer of Conflicts between Drawing and Specifications (Contract Documents) and between Contract Documents and references within the Contract Documents: Prospective contractors shall, in the processes of preparing their bids, enumerate, identify and list conflicts they find to exist within the Contract Documents, and between these Documents and the rules, regulations, standards and codes of the authority having jurisdiction (Airport Authority, City, County, etc.), local Utility companies and local County or State governing bodies. The Contractor shall notify the Engineer of discovered conflicts during the bidding process. No allowance shall subsequently be made to the Contractor by reason of his/her failure to have brought said discrepancies to the attention of the Engineer during the bidding period or by reason of any error on the Contractor’s part.
- c. Conflicts between Contract Documents and References not disclosed to the Engineer or discovered after bidding: Conflicts shall be resolved according to the most stringent or detailed requirements.
- d. Execution of Contract is evidence that Contractor has examined all existing conditions, drawings and specifications related to work, and is informed to extent and character of work. Claims made during construction for labor and materials required due to difficulties encountered as a result of Contractor’s inattention to this issue, which could have been clarified prior to bid had examination been made, will be denied.

100-1.5 SPECIFICATIONS AND STANDARDS. As a supplement to the installation requirements of this item, the following standard specifications and regulations of the issues in effect on the date of this solicitation are incorporated herein by reference and are made a part hereof for electrical work and installation and splicing of underground cables. Referenced documents – below and hereinafter in the L-series documents - shall be the current edition in force by the jurisdiction having authority.

NEC	National Electrical Code
FAA-STD-019	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities
FAA-C-1217	Electrical Work, Interior
FAA-C-1391	Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables

Utility Company Rules and Pacific Power
Regulations

Local Governing Bodies' Weed Airport
Codes and Regulations

100-1.6 SUBMITTALS, SHOP DRAWINGS AND MATERIAL LISTS. Prior to the installation of any material and equipment and within 30 days of contract award, the Contractor shall submit to the Owner for approval shop drawings, material lists and manufacturers' brochures containing complete dimensional and performance characteristics, wiring diagrams, installation and operation instructions, etc., for the equipment listed in the individual L-Series specification Items. The Contractor's submittals shall be either electronic submittals in PDF format.

A materials list shall be submitted listing each specification paragraph number and stating whether the materials proposed are as specified or are substitutions. If the item is a substitute item, a complete submittal as described in the above paragraph shall be provided for that item.

Unless otherwise coordinated with the Engineer, the submittal shall be complete and made in a single PDF. Partial submissions will not be reviewed or considered. 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.

Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

100-1.7 DIRECTIVE VERBS. The material in the L-Series specification Items and any referenced FAA Advisory Circulars (ACs), Orders, Specifications and Standards contain criteria, recommended practices and other guidance material which require the use of certain verbs such as **SHALL**, **MUST**, **SHOULD**, **WILL** and **MAY**. In these specifications and reference materials the explicit meanings of these verbs is as follows:

- a. SHALL.** The action is mandatory. For example: "Contractor **SHALL** coordinate with Operations and Maintenance 2 hours before the end of each daylight work shift to verify that all airfield lighting circuits are operational."
- b. MUST.** The action is mandatory. For example: "The localizer station **MUST** automatically shut down if the monitor detects an out of tolerance condition."
- c. SHOULD.** The action is desirable or recommended. For example: "The glide slope **SHOULD** be located 400 feet from the runway centerline."
- d. WILL.** The action is to be taken in the future. For example: "These items **WILL** not be available from Airport Maintenance." or "Some facilities **WILL** be programmed for upgrading to provide Category II performance."

e. **MAY.** The action is permissible. For example: "... it is expected that the Contractor MAY draw down this material for use in permanent installations." or "parking of unattended vehicles or aircraft within this area is prohibited at all times, except for maintenance vehicles which MAY be parked adjacent to the equipment shelter."

EQUIPMENT AND MATERIALS

100-2.1 EQUIPMENT. Conduits, conduit fittings, conductors, connectors, boxes, wiring devices, panelboards, and circuit breakers shall meet requirements of Specification FAA-C-1217.

100-2.2 CONDUIT, INTERIOR. Conduits installed building interiors shall be as follows:

- a. Exposed conduit and fittings shall be rigid galvanized steel (RGS). Conduits run on the exterior of the building above or below the grade for the earth grounding system shall be rigid zinc-coated steel. Radius of bends in RGS shall be minimum 12 nominal pipe diameters.
- b. Exposed conduits shall be galvanized steel electrical metallic tubing (EMT). Radius of bends in EMT shall be minimum 12 nominal pipe diameters. EMT fittings shall be compression type – set screw types are not acceptable.
- c. Conduit run in concrete or below slab on grade shall be per paragraph 100-2.3 below.

100-2.3 CONDUIT, EXTERIOR. Conduits in concrete slabs, in block walls or exterior exposed shall be rigid galvanized steel (RGS). Conduits run on the exterior of the building above or below the grade for the earth grounding system shall be rigid zinc-coated steel. Radius of bends in RGS shall be minimum 12 nominal pipe diameters. Rigid galvanized steel conduit run in concrete or below slab on grade, or in the ground, shall be field wrapped or shall have factory-applied coating as required in Specification FAA-C-1217. Field-made joints, fittings, abrasions and holidays shall be coated or wrapped with material equal to the original coating or wrapping.

100-2.4 CONDUIT, UNDERGROUND. Conduits run underground are specified in Item L-110 of these specifications.

100-2.5 600 VOLT WIRE. All wire shall have copper conductors. Size shall be American Wire Gauge (AWG) with size for power circuit as shown on the project drawings. All Power wire shall be stranded. Insulation shall be Type THWN-2 (above ground) or XHHW or XHHW-2 (below ground) and shall be continuous and color coded as follows:

		120/208V	277/480V
Line 1 or	Phase "A"	Black	Brown
Line 2 or	Phase "B"	Red	Orange
	Phase "C"	Blue	Yellow
	Neutral White		Gray

Ground	See Item 100-3.5
Control	Black with numbered adhesive
	Markers on both ends

All wire shall be continuous; no splices will be permitted. All wire shall be drawn into conduit with adequate lubricating compound to prevent damage to insulation. Pull tension shall not exceed manufacturer's recommendation.

100-2.6 SIGNAL AND CONTROL CABLES: All signal and control cables shall have copper conductors. Cable configuration and voltage rating shall be as shown on the plans. Assume 600 volt rating if none is shown.

100-2.7 5KV WIRE. All 5 KV cables for airfield lighting shall have copper conductors and shall be as specified in Item L-108.

100-2.8 CONDUIT FITTINGS. Each conduit and nipple entrance to junction boxes, panelboards, disconnect switches, duct, raceway, equipment cabinets, and other such electrical enclosures shall be fitted with double locknuts (one each side of metal penetrated) and insulating bushing. Bushings on 1-1/4 inch and larger conduits shall be insulated metallic, type OZ/Gedney Cat. No. IBC Series, or equal; bushings for 3/4 inch and 1 inch shall be plastic insulated T&B rated for 150 C, or equal. All insulated bonding and grounding bushings of conduits for 2400 volts or higher voltages, for conduit going underground, and for conduits going into concrete slabs shall be OZ/Gedney Cat. No. IBC-xxL (fitted with grounding lug), or equal. The bushings shall be connected to the grounding system within the terminating enclosure and not on the underground end. The buried end of each conduit shall be fitted with a thermosetting, plastic-insulated, metallic bushing. All openings where conduits enter junction boxes, other enclosures and shelters shall be sealed weathertight. The conduit shall be capped, if left empty, or sealed with Ducseal, or equal, around the conductors for exterior conduits.

100-2.9 UNDERGROUND DUCT. Concrete-encased and direct earth buried PVC ducts shall be as detailed on the plans. Directional bore PVC or HDPE ducts shall be as detailed on the plans. All ducts shall be as specified in Item L-110.

100-2.10 STRUCTURAL CONCRETE. Structural Concrete shall be as specified in Item P-610 and installed as detailed on drawings.

100-2.11 CONTROLLED LOW STRENGTH MATERIAL (CLSM). Not Used.

100-2.12 CONCRETE DUCT MARKERS. Markers shall be as specified in Item L-110 and as detailed on drawings.

100-2.13 CONCRETE MANHOLES AND HANDHOLES. Manholes and handholes shall be as specified in Item L-115 and as detailed on drawings.

100-2.14 LIGHT BASES AND TRANSFORMER HOUSING. Bases and covers shall be specified in item L-125 and as detailed on drawings.

100-2.15 OTHER ELECTRICAL EQUIPMENT. Cutouts, relays, terminal blocks, transfer relays, circuit breakers, and all other regularly used commercial items of electrical equipment not covered by FAA equipment specifications shall conform to the applicable rulings and standards of the Institute of Electrical and Electronic Engineers (IEEE) or the National Electrical Manufacturers Association (NEMA). When specified, test reports from a testing laboratory indicating that the equipment meets the specifications shall be supplied. In all cases, equipment shall be new and a first-grade product. This equipment shall be supplied in the quantities required for the specific project and shall incorporate the electrical and mechanical characteristics specified in the specification and plans.

CONSTRUCTION METHODS

100-3.1 EXISTING UTILITIES. Prior to any excavation or trenching, provide utility locator and verify any existing cables and utilities which will be crossed by the trench. Ensure these utilities are permanently disconnected if they are going to be demolished. The existing service lines shall be exposed by hand-digging in those areas that will be crossed and shall be protected from any possible damage. If any damage occurs, it shall be the Contractor's responsibility to immediately repair such damage with materials and methods approved by the Owner and in compliance with applicable codes and standards, at no additional cost to the Owner.

100-3.2 DEMOLITION.

a. Demolition. Removal of indicated portions of the airfield lighting system serving and associated taxiways as follows:

- (1) Remove indicated power and signal cables from conduits and ducts.
- (2) Demolish indicated conduits, ducts, handholes and concrete light and sign bases per the requirements of Item P-151 "Removal of Existing Facilities (Clearing)". Elements covered shall include the intent, but not be limited to the specific elements, of the following:
 - (a) Underground conduits and duct banks, both concrete encased and direct earth buried.
 - (b) Underground electrical concrete structures including manholes and handholes of varying sizes.
 - (c) Sign and light concrete encased bases and miscellaneous concrete footings.
- (3) Remove demolished material from site and dispose of according to local regulations.
- (4) Provide backfill meeting the requirements of P-152. Unless otherwise required for general Civil excavation and embankment, replacement backfill and paving repair shall be incidental to the demolition item.

b. Salvage. Removal and salvage of airfield electrical elements is included under this Item shall include the intent, but not be limited to the specific elements, of the following:

- (1) Light fixtures and isolation transformers.
- (2) Salvageable material and equipment slated for reinstallation including indicated signs, panels and lights shall be stored securely for reinstallation as noted on drawings.
- (3) Salvageable material and equipment not slated for reinstallation, and deemed salvageable by the Airport shall be removed and salvaged to the Airport as directed by appropriate Airport personnel.
- (4) All lights and retroreflective markers shall become the property of the Contractor and shall be removed from the site.

100-3.3 CLEANING AND RACKING OF MANHOLES AND HANDHOLES. Manholes and handholes through which new cables are to be pulled, or those designated by the Owner, shall be cleaned and have the cables racked as follows:

- a. Pump out standing water – enough to safely and thoroughly accomplish all of the other tasks.
- b. Remove mud/dirt at bottom of enclosure - enough to safely and thoroughly accomplish all of the other tasks as well as enough to uncover drain sumps, pulling eyes, etc.
- c. Remove non-affixed construction debris.
- d. Install new saddle racks per specification and as shown on the drawings
- e. Rack existing and new cables in loops around inside of enclosure. If slack in existing cables is insufficient for full cable loop, hang cables on rack(s) on one wall.

100-3.4 CLEANING AND RACKING OF MANHOLES AND HANDHOLES. Handholes through which new cables are to be pulled, or those designated by the Owner, shall be cleaned and have the cables racked as follows:

- a. Pump out standing water – enough to safely and thoroughly accomplish all of the other tasks.
- b. Remove mud/dirt at bottom of enclosure - enough to safely and thoroughly accomplish all of the other tasks as well as enough to uncover drain sumps, pulling eyes, etc.
- c. Remove non-affixed construction debris.
- d. Install new saddle racks per specification and as shown on the drawings
- e. Rack existing and new cables in loops around inside of enclosure. If slack in existing cables is insufficient for full cable loop, hang cables on rack(s) on one wall.

100-3.5 AIRFIELD POWER CONDUCTORS. Installation of underground 5 kV conductors is specified in Item L-108 of these specifications.

100-3.6 INSTALLATION OF MISCELLANEOUS CABLES AND CONDUCTORS. Where new cables or conductors are to be installed in an existing conduit which already contains cables or conductors, all of the existing cables or conductors shall be pulled from the conduit and the conduit cleaned as described

below. If, as noted on the drawings the re-use of the existing cable or conductors is intended - or as otherwise approved by the RPR.- all cables or conductors (new and re-used) shall then be pulled into the conduit as a bundled unit.

Existing underground conduit to be incorporated into a new/extended system shall be cleaned with a mandrel or cylinder wire brush and blown clean with compressed air.

100-3.7 GROUNDING. All metal support structures and metal enclosures shall be grounded in accordance with the requirements of the Specifications FAA-C-1217, FAA-C-1391, and FAA-STD-019, and as indicated on the drawings.

100-3.8 GROUND RODS. Grounding rods shall be 3/4-inch diameter by 10 feet long copper-jacketed steel. Grounding connections shall be by the exothermic weld process, Cadweld or equal. Extruded, drawn or stamped-type ground clamps will not be acceptable unless otherwise noted. The resistance to ground shall not exceed 25 ohms.

100-3.9 GROUND CONDUCTORS. Equipment grounding conductors shall be insulated copper, except where shown on the project drawings to be bare, and sized as shown on the project drawings; and all grounds will be shown in accordance of the National Electrical Code and with FAA-STD-019. Attachment of wire to supports, boxes, etc., shall be accomplished using approved ground lug attached with a separate stainless steel screw, lock washer and nut. Screws used for support of the electrical enclosure shall not be used for connection of the ground wire. Pipe straps shall not be used for ground purposes.

COLOR CODING OF GROUND CONDUCTORS

TYPE OF GROUND CONDUCTOR	COLOR OF INSULATION
Grounding Electrode Conductor	Bare - No Insulation
Equipment Grounding Conductor	Green (safety)
*Multipoint Ground (Frame)	Green with bright orange tracer
*Signal Ground	Green with bright yellow tracer

*Where these cables are concealed and not color coded, an exposed portion of the cable and each end of the cable for a minimum length of 2 feet shall be color coded with green tape overlaid with a bright orange or yellow to form a tracer. Where routed through raceways or wireways, the color coding shall be such that by removing or opening any one cover, the coding will be visible. Where conductors are routed through cable trays, color coding shall be accomplished at intervals not exceeding 3 feet.

The multi-ground system supplements but does not replace the equipment grounding conductor required by the National Electrical Code.

Each of these separate ground conductors is insulated in order to keep it distinct and not allow contact with any other conductor.

Electrical continuity of cable armor or shield shall be maintained. Grounding of the cable armor or shield shall be required at all terminations and shall be accomplished by connecting a #6 AWG solid bare copper wire to the cable armor or shield by means of a compression-type ground clamp installed within the terminating enclosure. Armor or shield ground wire shall be connected to the ground electrode conductor using split bolt connector, Burndy or equal. Grounding of direct earth burial (DEB) armored power and shielding control cable shall be at each end in accordance with FAA-C-1391.

100-3.10 IDENTIFICATION. Handhole, manhole, fixture and sign identification shall be as detailed on the drawings and as indicated in the associated “L” series Items. Cable tagging and markers shall be identified as per FAA-C-1391, Sections 3.5.1 and 2.

100-3.11 NOTIFICATION OF TESTING. The Contractor shall notify the Engineer and the Owner a minimum of 48 hours in advance of system, or partial system, testing, including but not limited to, installed cable megger testing, operational testing of any modified lighting circuit and fixture and signs photometric testing.

100-3.12 TESTING AND SUBMITTALS. Equipment and materials list and shop drawings shall be submitted as per FAA-C-1217, Section 5.1. Testing shall be required and performed as per FAA-C-1217, Section 5.3 and FAA-C-1391, Section 4. The Contractor shall be responsible for repairs or replacement of any cable found defective after installation.

The Contractor shall secure the services of an independent testing service to test the installed airfield lighting and miscellaneous power cables prior to the start of and at the completion of this project. The results of the testing shall be provided to the Owner for review and acceptance. The Contractor shall be responsible for repairs or replacement of any cable found defective after installation.

Installation tests in addition to all tests contained in other L-Series Items shall be provided as follows:

Item	Test Required	Manufacturer's Rep. Present?
5 kV Rated Airfield Lighting and Power Cables (On the Reel, Not Including Equipment for Contractor Quality Control. May be deleted per coordination with Engineer).	Megger check at 1000 volts prior to installation. Values of insulation resistance for each reel shall be noted and given to the Construction Manager or Resident Engineer and Owner for acceptance. It is expected that the readings will be greater than 1000 megohms (1 gigohm). <u>This test is for Contractor assurance and may be waived as coordinated with the Resident Engineer/Owner.</u>	No

Item	Test Required	Manufacturer's Rep. Present?
5 kV Rated Airfield Lighting and Power Cables (Installed in This Project)	Megger check at 1000 volts at the completion of installation. Test every circuit for conductor-to-ground and conductor-to-conductor (between circuits) insulation resistance. Test results shall be tabulated and given to the Construction Manager/Owner for acceptance. <u>It is required that the readings be greater than 100 megohms.</u>	No
5 kV Rated Airfield Lighting and Power Cables (All Circuits Modified in This Project, Emanating from any Lighting Vault)	Megger check at 1000 volts prior to the start of and at the completion of installation. Test every circuit for conductor-to-ground and conductor-to-conductor (between circuits) insulation resistance. Test results shall be tabulated and given to the Construction Manager or Resident Engineer and Owner for acceptance. End state circuits with megger test results significantly less than the start of construction test results shall be diagnosed and repaired to the Owner's satisfaction at Contractor's expense.	No
600 Volt Rated Power Cables (Installed in This Project)	Megger check at 500 volts prior to the start of and at the completion of installation. Test every circuit for conductor-to-ground and conductor-to-conductor (between circuits) insulation resistance. Test results shall be tabulated and given to the Engineer for acceptance. It is <u>required</u> that the readings be greater than 100 megohms. End state circuits with megger test results significantly less than the start of construction test results shall be diagnosed and repaired to the Owner's satisfaction at Contractor's expense.	No
5 kV and 600 Volt and Multi-pair Cables	If a power cable puller is used, continuous-tape pull tension readings for each section of cable shall be provided to the Construction Manager or Owner for review.	No

Item	Test Required	Manufacturer's Rep. Present?
Airfield Light Fixture (Testing prior to installation is for Contractor Quality Control. May be deleted per coordination with Engineer).	Each light fixture will be carefully examined prior to installation to ensure that lenses, where required, have been fitted, no signs of physical damage to the fittings exist and the lamps are working by connecting the fittings' electrical leads to a DC voltage source not exceeding 6 volts, such as a motorcycle battery. Any failures are to be reported to the Construction Manager or Owner. The fittings, when installed, shall be torqued to manufacturer's and FAA requirements and noted.	No

METHOD OF MEASUREMENT

100-4.1 AIRFIELD ELECTRICAL SYSTEM DEMOLITION. This Item consists of the removal of indicated portions of the airfield lighting system serving Weed Airport, of selected light fixtures, transformers and fixture bases, and retroreflective markers. This work also includes the removal of all conductors which are not to remain in service from ducts or conduits accessed under this project. Conduit, duct banks, fixture bases and concrete handholes are to be selectively demolished as part of the grading and excavation or abandoned in place.

BASIS OF PAYMENT

100-5.1 AIRFIELD ELECTRICAL SYSTEM DEMOLITION. Payment will be made at the contract Lump Sum price for the electrical demolition and removal services and incidental repair material completed and accepted. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete this Item as accepted by the Owner.

Payment will be made under:

Item L-100-1 Airfield Electrical System Demolition – Per Lump Sum

REFERENCE DOCUMENTS (All references shall be current edition)

National Fire Protection Association:

NFPA No. 70 National Electrical Code (NEC)

Underwriters Laboratories Inc.:

UL 67 Panelboards
UL 1283 Electromagnetic Interference Filters
UL 1449 Transient Voltage Surge Suppressors

Institute of Electrical and Electronics Engineers:

IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment
IEEE C62.41 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
IEEE C62.45 Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits

National Electrical Manufacturers Association:

NEMA AB 1 Molded Case Circuit Breakers and Molded Case Switches
NEMA FU 1 Low Voltage Cartridge Fuses
NEMA ICS 2 Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC
NEMA ICS 5 Industrial Control and Systems: Control Circuit and Pilot Devices
NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA LS 1 Low Voltage Surge Protection Devices
NEMA PB 1 Panelboards

NEMA PB 1.1 General Instructions for Proper Installation, Operation, and Maintenance of
Panelboards Rated 600 Volts or Less

ANSI/IEEE

ANSI/IEEE Std 81 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth
Surface Potentials of a Ground System

END OF ITEM L-100

Item L-108 Underground Power Cable for Airports

DESCRIPTION

108-1.1 This item shall consist of furnishing and installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the RPR. 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.

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 RPR.

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 RPR) 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 RPR 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 RPR, to determine compliance with the plans and specifications and shall be submitted in .PDF format. The RPR 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 **12 months** from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. The Contractor shall maintain a minimum insulation resistance in accordance with paragraph 108-3.10e with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period when tested in accordance

with AC 150/5340-26, *Maintenance Airport Visual Aid Facilities*, paragraph 5.1.3.1, Insulation Resistance Test.

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, non-shielded, 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, non-shielded, 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 Commercial Item Description A-A-59544A and shall be type THWN-2 unless otherwise noted, 75°C for installation in conduit and RHW-2, 75°C for direct burial installations. Conductors for parallel (voltage) circuits shall be type and size and installed in accordance with NFPA-70, National Electrical Code.

Unless noted otherwise, all 600-volt and less non-airfield lighting conductor sizes are based on a 75°C, THWN-2, 600-volt insulation, copper conductors, not more than three single insulated conductors, in raceway, in free air. The conduit/duct sizes are based on the use of THWN-2, 600-volt insulated conductors. The Contractor shall make the necessary increase in conduit/duct sizes for other types of wire insulation. In no case shall the conduit/duct size be reduced. The minimum power circuit wire size shall be #12 AWG.

Conductor sizes may have been adjusted due to voltage drop or other engineering considerations. Equipment provided by the Contractor shall be capable of accepting the quantity and sizes of conductors shown in the Contract Documents. All conductors, pigtails, cable step-down adapters, cable step-up adapters, terminal blocks and splicing materials necessary to complete the cable termination/splice shall be considered incidental to the respective pay items provided.

Cable type, size, number of conductors, strand and service voltage shall be as specified in the Contract Document.

108-2.3 Bare copper wire (counterpoise, bare copper wire ground and ground rods). Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare solid copper wire for counterpoise and/or No. 6 AWG insulated stranded for grounding bond wire per ASTM B3 and ASTM B8, and shall be **bare copper wire**. For voltage powered circuits, the equipment grounding conductor shall comply with NEC Article 250.

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 **10'** long and **3/4"** 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, and shall be one of the types listed below. No separate payment will be made for cable connections.

a. The cast splice. Not used.

b. The field-attached plug-in splice. Field attached plug-in splices shall be installed as shown on the plans. The Contractor shall determine the outside diameter of the cable to be spliced and furnish appropriately sized connector kits and/or adapters. Tape or heat shrink tubing with integral sealant shall be in accordance with the manufacturer's requirements. Primary Connector Kits manufactured by Amerace, "Super Kit", Integro "Complete Kit", or approved equal is acceptable.

c. The factory-molded plug-in splice. Specification for L-823 Connectors, Factory-Molded to Individual Conductors, is acceptable.

d. The taped or heat-shrink splice. Taped splices employing field-applied rubber, or synthetic rubber tape covered with plastic tape is acceptable. The rubber tape should meet the requirements of ASTM D4388 and the plastic tape should comply with Military Specification MIL-I-24391 or Commercial Item Description A-A-55809. Heat shrinkable tubing shall be heavy-wall, self-sealing tubing rated for the voltage of the wire being spliced and suitable for direct-buried installations. The tubing shall be factory coated with a thermoplastic adhesive-sealant that will adhere to the insulation of the wire being spliced forming a moisture- and dirt-proof seal. Additionally, heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits that are designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.

In all the above cases, connections of cable conductors shall be made using crimp connectors using a crimping tool designed to make a complete crimp before the tool can be removed. All L-823/L-824 splices and terminations shall be made per the manufacturer's recommendations and listings.

All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved equivalent, except that a light base ground clamp connector shall be used for attachment to the light base. 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 RPR 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 proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

108-2.7 Flowable backfill. Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

108-2.8 Cable identification tags. Cable identification tags shall be made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.

108-2.9 Tape. Electrical tapes shall be ScotchTM Electrical Tapes –ScotchTM 88 (1-1/2 inch (38 mm) wide) and ScotchTM 130C[®] linerless rubber splicing tape (2-inch (50 mm) wide), as manufactured by the Minnesota Mining and Manufacturing Company (3MTM), or an approved equivalent.

108-2.10 Electrical coating. Electrical coating shall be ScotchkoteTM as manufactured by 3MTM, or an approved equivalent.

108-2.11 Existing circuits. Whenever the scope of work requires connection to an existing circuit, the existing circuit's insulation resistance shall be tested, in the presence of the RPR. 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 RPR. When the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, in the presence of the RPR. The Contractor shall record the results on forms acceptable to the RPR. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the existing 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 Public Works Association (APWA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend 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. Detectable warning tape for communication cables shall be orange. Detectable warning tape color code shall comply with the APWA Uniform Color Code.

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. Cable shall be run without splices, from fixture to fixture.

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 RPR or shown on the plans.

In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points shall be installed at locations shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed and on both sides of slack loops where a future connector would be 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 RPR.

Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans.

108-3.2 Installation in duct banks or conduits. This item includes the installation of the cable in duct banks or conduit per the following paragraphs. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

The Contractor shall make no connections or splices of any kind in cables installed in conduits or duct banks.

Unless otherwise designated in the plans, where ducts are in tiers, use the lowest ducts to receive the cable first, with spare ducts left in the upper levels. Check duct routes prior to construction to obtain assurance that the shortest routes are selected and that any potential interference is avoided.

Duct banks or conduits shall be installed as a separate item per Item L-110, Airport Underground Electrical Duct Banks and Conduit. The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to ensure that the duct bank or conduit is open, continuous and clear of debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once

cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, light bases, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be re-cleaned at the Contractor's expense. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR 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 RPR prior to any cable installation. If required by the RPR, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the RPR. Cable pull tensions shall be recorded by the Contractor and reviewed by the RPR. 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 RPR, 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 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. Not used.

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. The joint where the connectors come together shall be finished by one of the following methods: (1) 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 (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches (38 mm) on each side of the joint or (3) On connector kits equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

c. Factory-molded plug-in splices. These shall be made by plugging directly into mating connectors. The joint where the connectors come together shall be finished by one of the following methods: (1) 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. (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches (38 mm) on each side of the joint. or (3) On connector kits so equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

d. Taped or heat-shrink splices. A taped splice shall be made in the following manner:

Bring the cables to their final position and cut so that the conductors will butt. Remove insulation and jacket allowing for bare conductor of proper length to fit compression sleeve connector with 1/4 inch (6 mm) of bare conductor on each side of the connector. Prior to splicing, the two ends of the cable insulation shall be penciled using a tool designed specifically for this purpose and for cable size and type. Do not use emery paper on splicing operation since it contains metallic particles. The copper conductors shall be thoroughly cleaned. Join the conductors by inserting them equidistant into the compression connection sleeve. Crimp conductors firmly in place with crimping tool that requires a complete crimp before tool can be removed. Test the crimped connection by pulling on the cable. Scrape the insulation to assure that the entire surface over which the tape will be applied (plus 3 inches (75 mm) on each end) is clean. After scraping, wipe the entire area with a clean lint-free cloth. Do not use solvents.

Apply high-voltage rubber tape one-half lapped over bare conductor. This tape should be tensioned as recommended by the manufacturer. Voids in the connector area may be eliminated by highly elongating the tape, stretching it just short of its breaking point. The manufacturer's recommendation for stretching tape during splicing shall be followed. Always attempt to exactly half-lap to produce a uniform buildup. Continue buildup to 1-1/2 times cable diameter over the body of the splice with ends tapered a distance of approximately one inch (25 mm) over the original jacket. Cover rubber tape with two layers of vinyl pressure-sensitive tape one-half lapped. Do not use glyptol or lacquer over vinyl tape as they react as solvents to the tape. No further cable covering or splice boxes are required.

Heat shrinkable tubing shall be installed following manufacturer's instructions. Direct flame heating shall not be permitted unless recommended by the manufacturer. Cable surfaces within the limits of the heat-shrink application shall be clean and free of contaminants prior to application.

e. Assembly. Surfaces of equipment or conductors being terminated or connected shall be prepared in accordance with industry standard practice and manufacturer's recommendations. All surfaces to be connected shall be thoroughly cleaned to remove all dirt, grease, oxides, nonconductive films, or other foreign material. Paints and other nonconductive coatings shall be removed to expose base metal. Clean all surfaces at least 1/4 inch (6.4 mm) beyond all sides of the larger bonded area on all mating surfaces. Use a joint compound suitable for the materials used in the connection. Repair painted/coated surface to original condition after completing the connection.

108-3.6 Bare counterpoise wire installation for lightning protection and grounding. If shown on the plans or included in the job specifications, bare solid #6 AWG copper counterpoise wire shall be installed for lightning protection of the underground cables. The RPR shall select one of two methods of lightning protection for the airfield lighting circuit based upon sound engineering practice and lightning strike density.

a. Equipotential. The counterpoise size is as shown on the plans. The equipotential method is applicable to all airfield lighting systems; i.e. runway, taxiway, apron – touchdown zone, centerline, edge, threshold and approach lighting systems. The equipotential method is also successfully applied to provide lightning protection for power, signal and communication systems. The light bases, counterpoise, etc – all components - are bonded together and bonded to the vault power system ground loop/electrode.

Counterpoise wire shall be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield cables. The counterpoise is centered over the cable/conduit/duct to be protected.

The counterpoise conductor shall be installed no less than 8 inches (200 mm) minimum or 12 inches (300 mm) maximum above the raceway or cable to be protected, except as permitted below:

(1) 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.

(2) 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, (45 degrees on each side of vertical creating a 90 degree angle).

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.

All components rise and fall at the same potential; with no potential difference, no damaging arcing and no damaging current flow.

See AC 150/5340-30, Design and Installation Details for Airport Visual Aids and NFPA 780, Standard for the Installation of Lightning Protection Systems, Chapter 11, for a detailed description of the Equipotential Method of lightning protection.

Reference FAA STD-019E, Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment, Part 4.1.1.7.

b. Isolation. Not used.

c. Common Installation requirements. 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.

Grounding electrodes may be rods, ground dissipation plates, radials, or other electrodes listed in the NFPA 70 (NEC) or NFPA 780.

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 wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet (150 m) apart around the entire circuit. The counterpoise system shall be continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode-grounding system. The connections shall be made as shown on the plans and in the specifications.

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.

d. Parallel Voltage Systems. Provide grounding and bonding in accordance with NFPA 70, National Electrical Code.

108-3.4 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 area of protection measured 45 degrees each side of vertical.

Where duct banks pass under pavement to be constructed in the project, the counterpoise shall be placed above the duct bank. Reference details on the construction plans.

108-3.5 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.

108-3.6 Exothermic bonding. Bonding of counterpoise wire shall be by the exothermic welding process or equivalent method accepted by the RPR. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the RPR, 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 AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.7 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 RPR. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the RPR. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

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

b. Should the counterpoise or ground grid conductors be damaged or suspected of being damaged by construction activities the Contractor shall test the conductors for continuity with a low resistance ohmmeter. The conductors shall be isolated such that no parallel path exists and tested for continuity. The RPR shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

After installation, the Contractor shall test and demonstrate to the satisfaction of the RPR the following:

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

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

e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than **100** megohms. Verify continuity of all series airfield lighting circuits prior to energization.

f. That the insulation resistance to ground of all new non-grounded conductors of new multiple circuits or circuit segments is not less than 100 megohms.

g. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.

h. 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.

i. That the impedance to ground of each ground rod does not exceed **25 ohms** prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test shall be used, as described by American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81, to verify this requirement. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. Test equipment and its calibration sheets shall be submitted for review and approval by the RPR prior to performing the testing.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the RPR. Where connecting new cable to existing cable, insulation resistance tests shall be performed on the new cable prior to connection to the existing circuit.

There are no approved “repair” procedures for items that have failed testing other than complete replacement.

METHOD OF MEASUREMENT

108-4.1 Cable, Cable Feeders or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet (meters) installed and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. The measurement for this item shall include additional quantities required for slack.

108-4.2 No separate payment will be made for ground rods.

BASIS OF PAYMENT

108-5.1 Payment will be made at the contract unit price for trenching, cable and bare counterpoise wire installed in trench (direct-buried), or cable and equipment ground installed in duct bank or conduit, in place by the Contractor and accepted by the RPR. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

Payment will be made under:

Item L-108-1	#8 AWG, L-824 Type C Cable, 5 kV Rated installed in duct bank or conduit – per linear foot
Item L-108-2	No. 6 AWG, Solid, Bare Copper Counterpoise Wire, Installed above the Duct Bank or Conduit Including Connections/Terminations - per linear foot

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 150/5340-26 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-59544A	Cable and Wire, Electrical (Power, Fixed Installation)
A-A-55809	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic
ASTM International (ASTM)	
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
Mil Spec	
MIL-PRF-23586F	Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical
MIL-I-24391	Insulation Tape, Electrical, Plastic, Pressure Sensitive
National Fire Protection Association (NFPA)	
NFPA-70	National Electrical Code (NEC)
NFPA-780	Standard for the Installation of Lightning Protection Systems
American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)	
ANSI/IEEE STD 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
Federal Aviation Administration Standard	
FAA STD-019E	Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment

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. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.

EQUIPMENT AND MATERIALS

110-2.1 General.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the RPR.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the RPR. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the RPR 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 RPR 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 RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be **electronically submitted in pdf format tabbed by section**. The RPR 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 **12 months** from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

110-2.2 Steel conduit. Rigid galvanized steel (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 mils of asphaltum sealer. When using PVC coated RGS conduit, care shall be exercised not to damage the factory PVC coating. Damaged PVC coating shall be repaired per the manufacturer's written instructions. In lieu of PVC coated RGS, corrosion wrap tape shall be permitted to be used where RGS is in contact with direct earth."

110-2.3 Plastic conduit. Plastic conduit and fittings shall conform to the following requirements:

- UL 514B covers W-C-1094-Conduit fittings all types, classes 1 thru 3 and 6 thru 10.
- UL 514C covers W-C-1094- all types, Class 5 junction box and cover in plastic (PVC).
- UL 651 covers W-C-1094-Rigid PVC Conduit, types I and II, Class 4.
- UL 651A covers W-C-1094-Rigid PVC Conduit and high-density polyethylene (HDPE) Conduit type III and Class 4.

Underwriters Laboratories Standards UL-651 and Article 352 of the current National Electrical Code shall be one of the following, as shown on the plans:

- a. Type I—Schedule 40 and Schedule 80 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 proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

110-2.7 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program. Precast concrete structures shall conform to ASTM C478.

110-2.9 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) red (electrical power lines, cables, conduit and lighting cable), orange (telephone/fiber optic cabling) 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.

CONSTRUCTION METHODS

110-3.1 General. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The RPR 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. Under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade; in other locations, the top of the duct bank or underground conduit shall be not less than 18 inches (0.5 m) below finished grade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch (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 RPR of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200-pound (90 kg) test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet (1.5 m).

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching

equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. Flowable backfill may alternatively be used

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 RPR. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (60 cm).

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the RPR, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the RPR.

All excavation shall be unclassified and shall be considered incidental to Item L-110. Dewatering necessary for duct installation, and erosion per federal, state, and local requirements is incidental to Item L-110.

Unless otherwise specified, excavated materials that are deemed by the RPR 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 RPR and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

- a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

- b. Trenching, etc., in cable areas shall then proceed with approval of the RPR, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

110-3.2 Duct banks. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches (0.5 m) below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 inches (75 mm) apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches (75 mm) thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot (1.5-m) intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the RPR 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 RPR.

110-3.3 Conduits without concrete encasement. Trenches for single-conduit lines shall be not less than 6 inches (150 mm) nor more than 12 inches (300 mm) wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch (6.3 mm) sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport's secured area where trespassing is prohibited are at least 18 inches (0.5 m) below the finished grade. Conduits outside the Airport's secured area shall be installed so that the tops of the conduits are at least 24 inches (60 cm) below the finished grade per National Electric Code (NEC), Table 300.5.

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

110-3.4 Markers. Not Used.

110-3.5 Backfilling for conduits. For conduits, 8 inches (200 mm) of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 except that material used for back fill shall be select material not larger than 4 inches (100 mm) in diameter.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

110-3.6 Backfilling for duct banks. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the requirements of Item P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet (76 m) of duct bank or one work period's construction, whichever is less.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

110-3.7 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include restoring the surface to native condition. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. All restoration shall be considered incidental to the respective L-110 pay item. Following restoration of all trenching near airport

movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

METHOD OF MEASUREMENT

110-4.1 Underground conduits and duct banks shall be measured by the linear feet of conduits and duct banks and directional bores installed, including encasement, locator tape, trenching and backfill with designated material all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank or directional bores completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for removal and disposal of existing duct banks and conduits as shown on the plans, 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-110-1	1-2" Sch. 40 PVC Conduit, Direct Buried - per linear foot
Item L-110-2	4-2" Sch. 40 PVC Duct Bank, Concrete Encased – per linear foot

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 Circular (AC)

AC 150/5340-30 Design and Installation Details for Airport Visual Aids

AC 150/5345-53 Airport Lighting Equipment Certification Program

ASTM International (ASTM)

ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

National Fire Protection Association (NFPA)

NFPA-70 National Electrical Code (NEC)

Underwriters Laboratories (UL)

UL Standard 6 Electrical Rigid Metal Conduit - Steel

UL Standard 514B Conduit, Tubing, and Cable Fittings

UL Standard 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL Standard 1242 Electrical Intermediate Metal Conduit Steel

UL Standard 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL Standard 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110

Item L-115 Electrical Manholes and Junction Structures

DESCRIPTION

115-1.1 This item shall consist of electrical manholes and junction structures (hand holes, pull boxes, junction cans, etc.) installed per this specification, at the indicated locations and conforming to the lines, grades and dimensions shown on the plans or as required by the RPR. This item shall include the installation of each electrical manhole and/or junction structures with all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, ladders, appurtenances, testing, dewatering and restoration of surfaces to the satisfaction of the RPR

EQUIPMENT AND MATERIALS

115-2.1 General.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the RPR.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the RPR) 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 RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be **electronically submitted in .PDF format**. The RPR 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 **12 months** from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

115-2.2 Concrete structures. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures. Cast-in-place concrete structures shall be as shown on the plans.

115-2.3 Precast concrete structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another engineer approved third party certification program. Provide precast concrete structures where shown on the plans.

Precast concrete structures shall be an approved standard design of the manufacturer. Precast units shall have mortar or bitumastic sealer placed between all joints to make them watertight. The structure shall be designed to withstand **22,000** lb or H-20 vehicle loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.

Threaded inserts and pulling eyes shall be cast in as shown on the plans.

If the Contractor chooses to propose a different structural design, signed and sealed shop drawings, design calculations, and other information requested by the RPR shall be submitted by the Contractor to allow for a full evaluation by the RPR. The RPR shall review per the process defined in the General Provisions.

115-2.4 Junction boxes. Junction boxes shall be L-867 Class 1 (non-load bearing). The light bases shall have a steel blank cover, gasket, and stainless steel hardware. All bolts, studs, nuts, lock washers, and other similar fasteners used for the light fixture assemblies must be fabricated from 316L (equivalent to EN 1.4404), 18-8, 410, or 416 stainless steel. If 18-8, 410, or 416 stainless steel is utilized it shall be passivated and be free from any discoloration. Covers shall be 3/8-inch (9-mm) thickness for L-867. All junction boxes shall be provided with both internal and external ground lugs.

115-2.5 Mortar. The mortar shall be composed of one part of cement and two parts of mortar sand, by volume. The cement shall be per the requirements in ASTM C150, Type I. The sand shall be per the requirements in ASTM C144. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15% of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C206. Water shall be potable, reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product.

115-2.6 Concrete. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

115-2.7 Frames and covers. The frames shall conform to one of the following requirements:

- a. ASTM A48 Gray iron castings
- b. ASTM A47 Malleable iron castings
- c. ASTM A27 Steel castings
- d. ASTM A283, Grade D Structural steel for grates and frames
- e. ASTM A536 Ductile iron castings
- f. ASTM A897 Austempered ductile iron castings

All castings specified shall withstand a maximum load of **22,000** lbs.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover unit shall be provided with fastening members to prevent it from being dislodged by traffic, but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

Each cover shall have the word "ELECTRIC" or other approved designation cast on it. Each frame and cover shall be as shown on the plans or approved equivalent. No cable notches are required.

Each manhole shall be provided with a “DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER” safety warning sign as detailed in the Contract Documents and in accordance with OSHA 1910.146 (c)(2).

115-2.8 Ladders. Not Used.

115-2.9 Reinforcing steel. All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A615, Grade 60.

115-2.10 Bedding/special backfill. Bedding or special backfill shall be as shown on the plans.

115-2.11 Flowable backfill. Not Used.

115-2.12 Cable trays. Cable trays or ladder racks shall be of galvanized steel.

115-2.13 Plastic conduit. Plastic conduit shall comply with Item L-110, Airport Underground Electrical Duct Banks and Conduits.

115-2.14 Conduit terminators. Conduit terminators shall be pre-manufactured for the specific purpose and sized as required or as shown on the plans.

115-2.15 Pulling-in irons. Pulling-in irons shall be manufactured with 7/8-inch (22 mm) diameter hot-dipped galvanized steel or stress-relieved carbon steel roping designed for concrete applications (7 strand, 1/2-inch (12 mm) diameter with an ultimate strength of 270,000 psi (1862 MPa)). Where stress-relieved carbon steel roping is used, a rustproof sleeve shall be installed at the hooking point and all exposed surfaces shall be encapsulated with a polyester coating to prevent corrosion.

115-2.16 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 **10'** long and **3/4"** in diameter.

CONSTRUCTION METHODS

115-3.1 Unclassified excavation. It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Damage to utility lines, through lack of care in excavating, shall be repaired or replaced to the satisfaction of the RPR without additional expense to the Owner.

The Contractor shall perform excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the RPR. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.

All excavation shall be unclassified and shall be considered incidental to Item L-115. Dewatering necessary for structure installation and erosion per federal, state, and local requirements is incidental to Item L-115.

Boulders, logs and all other objectionable material encountered in excavation shall be removed. All rock and other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the RPR. All seams, crevices, disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

The Contractor shall provide all bracing, sheeting and shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheeting and shoring shall be included in the unit price bid for the structure.

Unless otherwise provided, bracing, sheeting and shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner

that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

After each excavation is completed, the Contractor shall notify the RPR. Structures shall be placed after the RPR has approved the depth of the excavation and the suitability of the foundation material.

Prior to installation the Contractor shall provide a minimum of 6 inches (150 mm) of sand or a material approved by the RPR as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

115-3.2 Concrete structures. Concrete structures shall be built on prepared foundations conforming to the dimensions and form indicated on the plans. The concrete and construction methods shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the RPR before the concrete is placed.

115-3.3 Precast unit installations. Precast units shall be installed plumb and true. Joints shall be made watertight by use of sealant at each tongue-and-groove joint and at roof of manhole. Excess sealant shall be removed and severe surface projections on exterior of neck shall be removed.

115-3.4 Placement and treatment of castings, frames and fittings. All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the RPR and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

Field connections shall be made with bolts, unless indicated otherwise. Welding will not be permitted unless shown otherwise on the approved shop drawings and written approval is granted by the casting manufacturer. Erection equipment shall be suitable and safe for the workman. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to the RPR and approval of the method of correction shall be obtained. Approved corrections shall be made at Contractor's expense.

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

Pulling-in irons shall be located opposite all conduit entrances into structures to provide a strong, convenient attachment for pulling-in blocks when installing cables. Pulling-in irons shall be set directly into the concrete walls of the structure.

115-3.5 Installation of ladders. Ladders shall be installed such that they may be removed if necessary. Mounting brackets shall be supplied top and bottom and shall be cast in place during fabrication of the structure or drilled and grouted in place after erection of the structure.

115-3.6 Removal of sheeting and bracing. In general, all sheeting and bracing used to support the sides of trenches or other open excavations shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a structure shall be withdrawn, unless otherwise directed, before more than 6 inches (150 mm) of material is placed above the top of the structure and before any bracing is removed. Voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.

The RPR may direct the Contractor to delay the removal of sheeting and bracing if, in his judgment, the installed work has not attained the necessary strength to permit placing of backfill.

115-3.7 Backfilling. After a structure has been completed, the area around it shall be backfilled in horizontal layers not to exceed 6 inches (150 mm) in thickness measured after compaction to the density requirements in Item P-152. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

Backfill shall not be placed against any structure until approval is given by the RPR. In the case of concrete, such approval shall not be given until tests made by the laboratory under supervision of the RPR establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

Where required, the RPR may direct the Contractor to add, at his own expense, sufficient water during compaction to assure a complete consolidation of the backfill. The Contractor shall be responsible for all damage or injury done to conduits, duct banks, structures, property or persons due to improper placing or compacting of backfill.

115-3.8 Connection of duct banks. To relieve stress of joint between concrete-encased duct banks and structure walls, reinforcement rods shall be placed in the structure wall and shall be formed and tied into duct bank reinforcement at the time the duct bank is installed.

115-3.9 Grounding. A ground rod shall be installed in the floor of all concrete structures so that the top of rod extends 6 inches (150 mm) above the floor. The ground rod shall be installed within one foot (30 cm) of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor shall drill a 4-inch (100 mm) diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod.

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of one foot (30 cm) above the floor of the structure and separate from other cables. No. 2 American wire gauge (AWG) bare copper pigtailed shall bond the grounding bus to all cable trays and other metal hardware within the concrete structure. Connections to the grounding bus shall be exothermic. If an exothermic weld is not possible, connections to the grounding bus shall be made by using connectors approved for direct burial in soil or concrete per UL 467. Hardware connections may be mechanical, using a lug designed for that purpose.

115-3.10 Cleanup and repair. After erection of all galvanized items, damaged areas shall be repaired by applying a liquid cold-galvanizing compound per MIL-P-21035. Surfaces shall be prepared and compound applied per the manufacturer's recommendations.

Prior to acceptance, the entire structure shall be cleaned of all dirt and debris.

115-3.11 Restoration. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. The Contractor shall restore all disturbed areas equivalent to or better than their original condition. All sodding, grading and restoration shall be considered incidental to the respective Item L-115 pay item.

The Contractor shall grade around structures as required to provide positive drainage away from the structure.

Areas with special surface treatment, such as roads, sidewalks, or other paved areas shall have backfill compacted to match surrounding areas, and surfaces shall be repaired using materials comparable to original materials.

Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

After all work is completed, the Contractor shall remove all tools and other equipment, leaving the entire site free, clear and in good condition.

115-3.12 Inspection. Prior to final approval, the electrical structures shall be thoroughly inspected for conformance with the plans and this specification. Any indication of defects in materials or workmanship shall be further investigated and corrected. The earth resistance to ground of each ground rod shall not exceed 25 ohms. Each ground rod shall be tested using the fall-of-potential ground impedance test per American National Standards Institute / Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81. This test shall be performed prior to establishing connections to other ground electrodes.

115-3.13 Manhole elevation adjustments. Not Used.

115-3.14 Duct extension to existing ducts. Where existing concrete encased ducts are to be extended, the duct extension shall be concrete encased plastic conduit. The fittings to connect the ducts together shall be standard manufactured connectors designed and approved for the purpose. The duct extensions shall be installed according to the concrete encased duct detail and as shown on the plans.

METHOD OF MEASUREMENT

115-4.1 Electrical handholes and junction structures shall be measured by each unit completed in place and accepted. The following items shall be included in the price of each unit: All required excavation and dewatering; sheeting and bracing; all required backfilling with on-site materials; restoration of all surfaces and finished grading and turfing; all required connections; temporary cables and connections; and ground rod testing

BASIS OF PAYMENT

115-5.1 The accepted quantity of electrical handholes and junction structures will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

Payment will be made under:

Item L-115-1	H-20 Load Rated Concrete Handhole - Per Each
Item L-115-2	L-867B Base can with Steel Lid – Per Each

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.

American National Standards Institute / Insulated Cable Engineers Association (ANSI/ICEA)

ANSI/IEEE STD 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
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Advisory Circular (AC)

AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-42	Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-53	Airport Lighting Equipment Certification Program

Commercial Item Description (CID)

A-A 59544	Cable and Wire, Electrical (Power, Fixed Installation)
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ASTM International (ASTM)

ASTM A27	Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A123	Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A897	Standard Specification for Austempered Ductile Iron Castings
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C206	Standard Specification for Finishing Hydrated Lime

FAA Engineering Brief (EB)

EB #83	In Pavement Light Fixture Bolts
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Mil Spec

MIL-P-21035	Paint High Zinc Dust Content, Galvanizing Repair
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National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)
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END OF ITEM L-115

Item L-125 Installation of Airport Lighting Systems

DESCRIPTION

125-1.1 This item shall consist of airport lighting systems furnished and installed in accordance with this specification, the referenced specifications, and the applicable advisory circulars (ACs). The systems shall be installed at the locations and in accordance with the dimensions, design, and details shown in the plans. This item shall include the furnishing of all equipment, materials, services, and incidentals necessary to place the systems in operation as completed units to the satisfaction of the RPR.

EQUIPMENT AND MATERIALS

125-2.1 General.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified under the Airport Lighting Equipment Certification Program in accordance with AC 150/5345-53, current version. FAA certified airfield lighting shall be compatible with each other to perform in compliance with FAA criteria and the intended operation. If the Contractor provides equipment that does not perform as intended because of incompatibility with the system, the Contractor assumes all costs to correct the system for to operate properly.

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

c. All materials and equipment used shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Clearly 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 clearly made with arrows or circles (highlighting is not acceptable). The Contractor shall be responsible for delays in the project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted in **electronic pdf format**. The RPR reserves the right to reject any or all equipment, materials or procedures, which, in the RPR's opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least **12 months** from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

EQUIPMENT AND MATERIALS

125-2.2 Conduit/Duct. Conduit shall conform to Specification Item L-110 Airport Underground Electrical Duct Banks and Conduits.

125-2.3 Cable and Counterpoise. Cable and Counterpoise shall conform to Item L-108 Underground Power Cable for Airports.

125-2.4 Tape. Rubber and plastic electrical tapes shall be Scotch Electrical Tape Numbers 23 and 88 respectively, as manufactured by 3M Company or an approved equal.

125-2.5 Cable Connections. Cable Connections shall conform to Item L-108 Installation of Underground Cable for Airports.

125-2.6 Retroreflective Markers. Retroreflective markers shall be type L-853, blue, stake mounted and shall conform to the requirements of AC 150/5345-39.

125-2.7 Runway and Taxiway Lights. Not used.

125-2.8 Runway and Taxiway Signs. Retroreflective signs shall conform to the requirements of AC 150/5345-44. Retroreflective signs installed in this project shall be Size 1. Sign legends and installation shall be as detailed in the plans.

125-2.9 Runway End Identifier Light (REIL). Not used.

125-2.10 Precision Approach Path Indicator (PAPI). Not used.

125-2.11 Visual Approach Slope Indicator (VASI). Not used.

125-2.11 Circuit Selector Cabinet. Not used.

125-2.12 Light Base and Transformer Housings. Light Base and Transformer Housings should conform to the requirements of AC 150/5345-42. Light bases shall be Type L-867, Class **1A**, Size **B** shall be provided as indicated or as required to accommodate the fixture or device installed thereon. Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures.

125-2.13 Isolation Transformers. Isolation Transformers shall be Type **L-831**, size as required for each installation. Transformer shall conform to AC 150/5345-47.

INSTALLATION

125-3.1 Installation. The Contractor shall furnish, install, connect and test all equipment, accessories, conduit, cables, wires, buses, grounds and support items necessary to ensure a complete and operable airport lighting system as specified here and shown in the plans.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and state and local code agencies having jurisdiction.

The Contractor shall install the specified equipment in accordance with the applicable advisory circulars and the details shown on the plans.

125-3.2 Testing. All lights shall be fully tested by continuous operation for not less than 24 hours as a completed system prior to acceptance. The test shall include operating the constant current regulator in each step not less than 10 times at the beginning and end of the 24-hour test. The fixtures shall illuminate properly during each portion of the test.

125-3.3 Shipping and Storage. Equipment shall be shipped in suitable packing material to prevent damage during shipping. Store and maintain equipment and materials in areas protected from weather and physical damage. Any equipment and materials, in the opinion of the RPR, damaged during construction or storage shall be replaced by the Contractor at no additional cost to the owner. Painted or galvanized surfaces that are damaged shall be repaired in accordance with the manufacturer's recommendations.

125-3.4 Elevated Lights. Water, debris, and other foreign substances shall be removed prior to installing fixture base and light.

METHOD OF MEASUREMENT

125-4.1 Reflective markers will be measured by the number installed as completed units in place, ready for operation, and accepted by the RPR. Retroreflective signs will be measured by the number of each type installed as completed units in place, ready for operation, and accepted by the RPR.

BASIS OF PAYMENT

125-5.1 Payment will be made at the Contract unit price for each complete runway, reflective marker, installed by the Contractor and accepted by the RPR. This payment will be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Item L-125-1	L-853 Retro-reflective Marker, Stake Mounted – per Each
Item L-125-2	Size 1 Retro-reflective Airfield Guidance Sign – per Each

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 150/5340-18	Standards for Airport Sign Systems
AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-5	Circuit Selector Switch
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 150/5345-28	Precision Approach Path Indicator (PAPI) Systems
AC 150/5345-39	Specification for L-853, Runway and Taxiway Retroreflective Markers
AC 150/5345-42	Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
AC 150/5345-44	Specification for Runway and Taxiway Signs
AC 150/5345-46	Specification for Runway and Taxiway Light Fixtures
AC 150/5345-47	Specification for Series to Series Isolation Transformers for Airport Lighting Systems
AC 150/5345-51	Specification for Discharge-Type Flashing Light Equipment

AC 150/5345-53
Engineering Brief (EB)

EB No. 67

Airport Lighting Equipment Certification Program

Light Sources Other than Incandescent and Xenon for Airport and
Obstruction Lighting Fixtures

ATTACHMENT A - GEOTECHNICAL REPORT

Geotechnical Investigation

Weed Airport

Taxiway and Aircraft Parking

Apron

Siskiyou County, California

March 15, 2023

Prepared for
Kimley-Horn and Associates, Inc.

Prepared By



Corestone Engineering, Inc.



CORESTONE ENGINEERING, INC.
Geotechnical Services & Construction Materials Testing

Mr. Heath Hildebrandt, P.E.
Kimley-Horn and Associates, Inc.
7900 Rancharrah Parkway, Suite 100
Reno, NV 89511

March 15, 2023
Project No.: 5013-03-1

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**RE: Geotechnical Investigation
Weed Airport Taxiway and Aircraft Parking Apron
Siskiyou County, California**

Dear Mr. Hildebrandt:

Corestone Engineering, Inc. is pleased to present the results of our geotechnical investigation for the proposed airport asphalt concrete pavement reconstruction project at Weed Airport (O46) in Siskiyou County, California. Our investigation consisted of research, field exploration, laboratory testing, and geotechnical analysis to develop geotechnical recommendations for the proposed pavement reconstruction project. Pavement analyses were completed by Kimley-Horn and Associates, Inc.

The project will include the design and reconstruction of an asphalt concrete taxiway and apron at the Weed Airport (O46) located north of the town of Weed in Siskiyou County, California. Depending on the final design and budget, several hundred thousand square feet of existing asphalt concrete pavement may be reconstructed. The design and construction of the project will follow Federal Aviation Administration (FAA) requirements.

The subgrade soils beneath the existing pavements predominantly consist of non-expansive, silty sand with gravel soils that are considered non-cohesive per FAA design guidelines. The existing structural sections within the project area consists of 1.5 to 3 inches of asphalt concrete underlain by about 6.5 to 11 inches aggregate base. Depending on the final design, the reconstruction may utilize a full-depth reclamation of existing asphalt concrete and underlying base for use as recycled aggregate asphalt concrete base for the new pavement.

We appreciate having the opportunity to work with you on this project. If you have any questions regarding the content of the attached report, please do not hesitate to contact us.

Sincerely,

Corestone Engineering, Inc.

Vimal P. Vimalaraj, P.E., G.E.
President
PV:RVS:pv/lkv



3.15.2023

Copies to: Addressee (PDF)



Corestone Engineering, Inc.
775-636-5916

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Introduction

Presented herein are the results of Corestone Engineering, Inc.'s (CEI's) geotechnical investigation, laboratory testing, and associated geotechnical design recommendations for the design and reconstruction of the taxiway and aircraft parking at the Weed Airport located north of the town of Weed in Siskiyou County, California. These recommendations are based on surface and subsurface conditions encountered in our explorations and on details of the proposed project as described in this report. The objectives of this study were to:

1. Determine general soil and groundwater conditions pertaining to design and construction of the proposed airport pavement reconstruction project.
2. Provide geotechnical recommendations for design and construction of the project as related to the geotechnical conditions encountered in our study.

The area covered by this report is shown on Plate 1 (Plot Plan). Our investigation included field exploration, laboratory testing, and limited geotechnical engineering analysis to determine the physical and mechanical properties of the various on-site materials. Results of our field exploration and testing programs are included in this report and form the basis for all geotechnical data, conclusions, and recommendations.

The services described above were conducted in accordance with the Kimley-Horn and Associates, Inc. (KH) Master Agreement for Continuing Professional Services between KH and a Subconsultant dated July 29, 2021, and the Individual Project Order Number 02 dated September 18, 2021, issued by KH for the subject Weed Airport project.



Project Description

The Weed Airport project site is located approximately 5 miles north of the town of Weed in Siskiyou County, California. The overall airport is contained in Sections 17, 18 and 20, Township 42 North, Range 5 West, Mount Diablo Meridian. The project area consists of the existing taxiway that runs the entire length of runway 14-32, several other smaller taxiways leading to the airport hangers and parking apron to the west, and the aircraft parking apron within the southwestern portion of the airport. The project site is bordered to the north and south by undeveloped land, to the east by existing drainage area and the runway, to the west by undeveloped land and the rest area associated with Interstate Highway (I)-5. Weed Airport Road provides access to the airport off I-5.

The project will involve the design and reconstruction of an asphalt concrete taxiway and apron at the Weed Airport (O46) located north of the town of Weed in Siskiyou County, California. Final reconstruction limits and design details were not available at the time of this report. It is expected entire main taxiway that runs for the full length of runway will be reconstructed. The aircraft parking apron within the southern limits of the airport limit off airport entry way as well as other short taxiways that runs from the main taxiway, taxiway between the airport hangers will also be constructed. It is our understanding the project will also include improvement to surface drainage conditions via providing appropriate drainage slopes to the airport pavements. Aircraft loading on the taxiway and parking apron involve light aircraft with gross weights of 10,000 pounds or less. The driveway and aircraft parking areas will also be subject to irregular maintenance and fueling truck traffic. The pavement design for the project is to be completed by KH using the information contained in this geotechnical report.

The reconstructed AC pavement will need to match the grades of the finished grades at the existing improvements. As such, it is expected only minimal grading will be necessary on the project. Any minor grading on the project will essentially be to provide appropriate surface drainage for stormwater runoff to minimize ponding of water.



Site Conditions

The existing pavements within the project area at Weed Airport appears to be a few decades old. Based on the review of Google Earth™ historical aerial images, the airport may have been originally constructed with unpaved runway several decades ago. The existing runway may have been recently repaved based on the conditions observed in the field. The main taxiway is located west of the runway and is connected to the runway at 5 locations. The aircraft parking apron is located within the southwestern limits of the overall airport premises. The main entry way to the airport leads to a parking lot that is connected to the aircraft parking apron and the main airport/maintenance building is located at the south end of the parking lot. The airport fueling station/storage area is located at the south end of the aircraft parking apron. A separate taxiway that extends north from the aircraft parking apron provide access to several small metal-framed aircraft hangars. The rest area associated with I-5 is located just west of the north end of the aircraft parking apron beyond the airport security fence.

The project area is relatively flat with minor drainage slopes to the unimproved medians that lie slightly below the existing pavement surfaces. The project area is devoid of vegetation. However, moderate vegetation exists beyond the limits of the pavements and on the fill slopes of the northern limit of the taxiway. There are surficial boulders within the native areas beyond the airport pavements; the area of south of the south end of taxiway shows a heavy concentration of surficial cobbles and large boulders.

The existing asphalt concrete pavements within the taxiway and parking apron are serviceable but they are most likely beyond their design life. The taxiway exhibits transverse cracks at about 50 to 60 feet spacing through the entire length. Majority of the cracks are over 1 inch in width and some cracks are over 2 inches in width. Previous crack filling is present within most of the cracks. In addition to transverse cracking, there are areas of surface raveling and localized areas of fatigue cracking exist within the taxiway pavement. The aircraft parking apron and the taxiway leading to the aircraft hangars exhibit longitudinal cracks, transverse cracks, and several areas of random and fatigue cracks. Previous crack filling exists within most of these cracks. The taxiway that leads north from the hangars exhibit intense surface raveling.



Existing Taxiway - View to the North (Runway on the Right)



Exploration

Field exploration for the project included advancement of 12 borings. The borings were advanced to reveal the existing structural section and underlying subgrade soils. The locations of the borings were selected by KH to provide a uniform distribution over the reconstruction project area in general accordance with the Federal Aviation Administration (FAA) Advisory Circular No. 150/5320-6G (FAA, 2021). Prior to the exploration, CEI contacted Underground Service Alert to mark the major public utilities. After the exploration was complete, borings were backfilled with drill spoils within the lower section and then by cement grout.

Drilling

The Weed Airport Project site was explored on October 19 and 20 of 2021, by drilling 12 test borings (B-01 through B-12) using a trailer-mounted CME 45 soils sampling drill rig. All borings were advanced using solid-flight auger drilling method and the maximum depth of exploration was 10 feet below the existing pavement surface. The locations of the test borings are shown on Plate 1.

The native soils were sampled in-place every 2.5 feet by use of a standard, 2-inch-O.D., split-spoon sampler driven by a 140-pound auto hammer with a 30-inch stroke. The number of blows to drive the sampler the final 12 inches of an 18-inch penetration (Standard Penetration Test [SPT] - American Society for Testing and Materials [ASTM] D 1586) into undisturbed soil is an indication of the density and consistency of the material.

A 3- $\frac{1}{2}$ -inch-O.D., split-spoon sampler (ASTM D 3550; aka Modified California [MC] sampler) was also used to sample soils at the horizons where in-situ dry densities of the subgrade soils were required, generally within subgrade at shallow depths. Sampling methods used were similar to the SPT but also included the use of 2- $\frac{1}{2}$ -inch-diameter, 6-inch-long, stainless steel sampling tubes placed inside the split-spoon sampler. Because of



Drilling Exploration



the larger diameter of the sampler, blowcounts are typically higher than those obtained with the SPT and should not be directly equated to SPT blowcounts. The logs, included as Plate 2 (Boring Logs), indicate the type of sampler used for each sample.

Due to the relatively small diameter of the samplers, the maximum panicle size that could be obtained was approximately 1.5 inches. The final logs may not, therefore, adequately represent the actual quantity or presence of oversized particles. Several borings encountered refusal SPT blowcounts at various depths, which may indicate the presence of some oversized particles or hard strata.

Material Classification

A geotechnical engineer examined and identified all soils in the field in accordance with ASTM D 2488. Geotechnical engineer also measured the existing structural section (asphalt concrete and underlying aggregate base) at each boring location. During drilling exploration, representative bulk samples were placed in sealed plastic bags and returned to Reno, Nevada, for additional evaluation and laboratory testing. Additional soil classification was subsequently performed in accordance with ASTM 2487 (Unified Soil Classification System [USCS]) upon completion of laboratory testing, as described in the **Laboratory Testing** section. Logs of the test borings are presented in Plate 2, and a USCS chart has been included as Plate 3 (USCS Soil Classification Chart).

Table 1 (Field Exploration Results Summary) provides the summary of the structural section thicknesses measured in the field exploration and the subgrade USCS soil type.



TABLE 1 - FIELD EXPLORATION RESULTS SUMMARY

Boring (B) No.	Existing Asphalt Concrete Thickness (Inches)	Existing Aggregate Base Thickness (Inches)	Subgrade Predominant Soil Type (USCS) ¹
B-01	2.75	11.25	SM
B-02	3.00	9.50	SM
B-03	2.25	9.25	SM
B-04	2.00	10.00	SM
B-05	2.50	9.00	SM
B-06	2.50	8.50	SM
B-07	3.00	5.50	GW-GM
B-08	2.75	7.25	GC
B-09	2.75	7.25	SM
B-10	2.50	7.25	SM ¹
B-11	1.75	9.25	SM
B-12	1.50	6.50	SP-SM

¹Classification was based on the gradation and plasticity index test results on the bulk sample from drill cuttings.



Laboratory Testing

Corestone Engineering, Inc. subcontracted Geotechnical & Environmental Services, Inc. of Reno, Nevada to complete laboratory testing to analyze soil characteristics (detailed below) in general accordance with the standards and methodologies described in Volume 4.08 of the ASTM Standards. Chemical testing detailed below were performed by Silver State Analytical Laboratories of Reno, Nevada and total petroleum hydrocarbon testing were completed by Alpha Analytical Inc. of Sparks, Nevada.

Index Tests

Samples of subgrade soils were analyzed to determine their in-situ moisture content (ASTM D 2216), grain size distribution (ASTM D 422), and plasticity index (ASTM D 4318). Grain size distribution testing included sieve analysis (ASTM D 6913) on all samples tested as well as hydrometer analysis (ASTM D 7928) and soil specific gravity (ASTM D 854) on selected samples. Moisture content and dry density testing (ASTM D 2937) were also performed on selected MC samples of subgrade soils collected at shallow depths. The results of these tests are shown on Appendix A (Index Test Results). The soil specific gravity values are noted on the remark section of the grain size distribution results included in Appendix A. Test results were used to classify the soils according to ASTM D 2487 and to verify field logs, which were then updated as appropriate. Classification in this manner provides an indication of the soil's mechanical properties and is used in geotechnical analysis of subgrade soils. The in-place density values for the MC samples collected at shallow depths can be compared with maximum laboratory density values to determine the relative compaction of in-place soils for use in the evaluation of compaction requirements in the airport pavement design.

Table 2 (In-Place Dry Density, Moisture Content, and Relative Compaction of Near-Surface Soils) provides a summary of the in-place density and moisture content test results and, as applicable, estimated in-place relative compaction based on the results from moisture-density relation testing (ASTM D 698) performed as part of California Bearing Ratio (CBR) tests (ASTM D 1883) discussed below under **California Bearing Ratio Tests**.



TABLE 2 - IN-PLACE DENSITY, MOISTURE CONTENT AND RELATIVE COMPACTION OF SUBGRADE SOILS

Boring (B) No.	Depth (feet)	Field Density (pcf) ¹	Field Moisture Content (%)	USCS Soil Type ²	Applicable Laboratory Maximum Dry Density (pcf) ³	Estimated Field Relative Compaction (%)
B-01	1.0	113.6	6.3	SM	119.5	95
B-02	1.0	107.2	7.5	SM	119.5	90
B-03	1.0	120.0	0.9	SM	NT	NA
B-05	1.0	107.9	16.6	SM	113.9	95
B-06	1.0	107.6	7.7	SM	NT	NA
B-07	1.0	111.7	10.4	GW-GM	NT	NA
B-08	1.0	114.8	17.5	SM	124.2	92
B-09	1.0	121.0	11.6	SM	124.2	97
B-10	1.0	119.7	19.8	SM	113.9	>100
B-11	1.0	101.1	14.1	SM	NT	NA

¹ASTM D 2937. pcf - pounds per cubic foot

² Based on gradation and plasticity index testing on MC samples or combined bulk samples, as available.

³ ASTM D 698. Performed as part of CBR testing on bulk sample collected from drill cuttings from 2 borings.

⁴ NT - Not Tested.

⁵ NA - Not Applicable. Laboratory maximum density values are not available.

Laboratory Moisture-Density Relationship Tests

Three standard moisture-density relationship (Proctor) tests (ASTM D 698) were performed on all 3 representative subgrade soil samples selected for CBR tests, as part of the CBR test requirements. Samples were collected below the existing asphalt concrete and aggregate base to an approximate depth of 4 feet below existing grade. Due to the sample size, subgrade soils from 2 borings exhibiting similar soil type based on field classification were combined to complete proctor tests and the CBR tests. The maximum dry densities and optimum moisture contents from these test results were utilized to prepare samples for CBR testing as described below. The moisture-density curves are included as Appendix B (Moisture-Density Relationship Test Results).

California Bearing Ratio Tests

A total of 3 CBR tests (ASTM D 1883) were completed on bulk samples of drill cuttings collected from representative boring locations. Initially, moisture-density relation testing (ASTM D 698) was completed on each subgrade sample for CBR testing to determine the laboratory maximum dry density and associated



optimum moisture content. The results of CBR tests are included in Appendix C (CBR Test Results). Appendix B also shows laboratory maximum dry density (in pounds per cubic foot [pcf]) and associated optimum moisture content values for each sample determined per ASTM D 698. The results of the CBR tests are summarized in Table 3 (CBR Test Results Summary).

TABLE 3 - CBR TEST RESULTS SUMMARY					
Boring (B) Nos.	Depth Interval (feet)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	CBR ¹	USCS Soil Type
B-01 and B-02	1.0 - 4.0	119.5	7.5	15	SM
B-05 and B-10	1.0 - 4.0	113.9	12.3	9 ²	SM
B-08 and B-09	1.0 - 3.5	124.2	9.7	16	SM

¹ At 100 percent relative compaction as determined per ASTM D 698.

² Inconsistent relative compaction values. Value for 56-blow point is reported for CBR at 100 percent relative compaction.

Chemical Tests

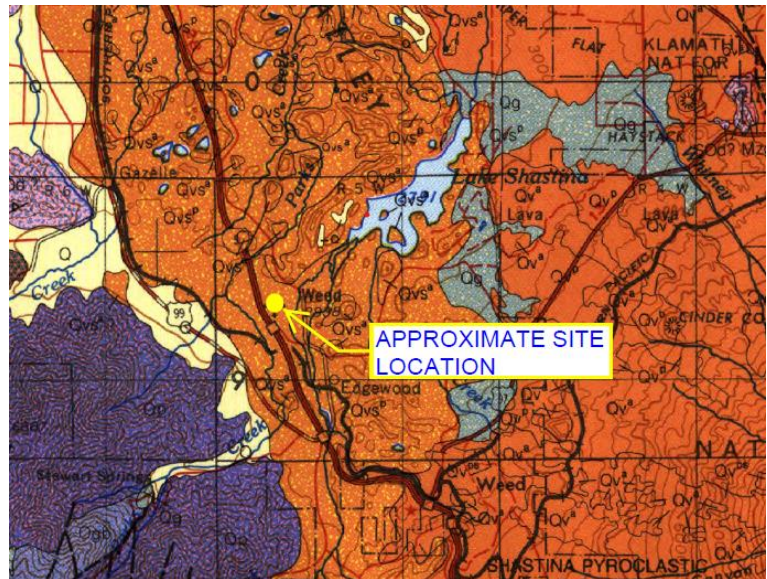
Corrosion testing (pH, resistivity, soluble sulfates, and chlorides) was completed on a selected representative sample of subgrade soils. Total petroleum hydrocarbon testing was also completed on a subgrade soil sample collected from the boring B-11 that was advanced in the vicinity of the exiting fueling area associated with the airport. The results of the chemical tests are shown on Appendix D (Chemical Test Results).



Geologic and General Soil Conditions

The Weed Airport is located near the southern end of a large region known as the Cascade Range Geomorphic Province. This region is characterized by a chain of volcanic cones that extend from Northern California into Oregon and Washington. Mt. Shasta, a dormant volcano, lies approximately 14 miles southeast of the site. Lava flows and other volcanic deposits compose much of the surface deposits in

this region. Mapping by the California Geological Survey indicates the project area is located within Quaternary age *Volcanic rocks of Shasta Valley* consisting of pyroclastic deposits (Wagner and Saucedo, 1987). Geotechnical exploration encountered mostly dense to very dense coarse-grained soil-like materials that are pyroclastic deposits mapped by the geological map. Andesite volcanic rocks are also mapped in the nearby area.



Geologic Map

The native materials at the airport site are predominantly dense to very silty sand with gravel soils exhibiting up to 25 percent non-plastic to low plasticity fines and as much as 40 percent subangular to angular gravel up to 2 inches in diameter. The northern end of the taxiway (and runway) lies in existing fill that are likely generated onsite via cut to fill operation for the airport construction. The northern borings B-01 and B-02 encountered silty sand with gravel fill soils through about 6 feet below existing pavement surface and these fill soils exhibit similar mechanical characteristics as the native subgrade soils encountered within the southern limits of the airport that lie in cuts. The subgrade soils locally vary from poorly graded sand with silt and gravel to silty gravel to clayey gravel with sand soils. The borings advanced within the northern limits of the aircraft parking area and the taxiway that leads in between the small aircraft hangers encountered relatively shallow refusal on very dense volcanic deposits or cobbles/boulders (hard volcanic rocks) in the volcanic rock units mapped in the area. Contractor should be aware of encountering hard materials and possible need for aggressive techniques in the grading and trenching work in this area.

Groundwater was not encountered during exploration and is expected to lie at a depth below that which would affect project design or construction. Perched seepage water was encountered in boring B-08 advanced within the aircraft parking area. Due to very dense consistency, native volcanic rock units will likely have low permeability as such any standing water in a low area can percolate and travel within the



upper permeable strata in seepage/perched water conditions. It is noted that standing water was present during our exploration in the drainage/channel area just east of the northern aircraft parking apron where boring B-08 was located.



Geologic Hazards

Seismicity and Faults

Much of the western United States is a region of moderate to intense seismicity related to the movement of crustal masses (plate tectonics). The Weed area lies within a region with a potential for moderate earthquake shaking.

The United States Geological Survey (USGS) Quaternary Fault and Fold Database (2021) does not show any faults within 9 miles of the airport. Because no faults of any age are mapped as crossing the project site and the proposed runway and taxiway projects do not include an occupied structure, no further fault hazard investigation or mitigation is necessary.

Ground Motion and Liquefaction

The United States Geological Survey seismic design maps that have been incorporated with the American Society of Civil Engineers (ASCE) Online *ASCE 7 Hazard Tool* indicate that there is a 2 percent probability that a *bedrock* ground acceleration of 0.25 g will be exceeded in any 50-year interval (ASCE, 2021).

Weed Airport project site is located within an area exhibiting shallow volcanic rock units and a relatively deep groundwater table. As such, the potential for soil liquefaction is low at the site.

Volcanic Activity

Mt. Shasta is located approximately 14 miles southeast of the Weed airport. Mt. Shasta is considered a dormant volcano, but it has the potential to erupt again. On average the volcano has erupted once per 600 years during the last 4,500 years. Based on radiocarbon dating, the last eruption occurred about 200 years ago (Miller, 1980). It is impossible to predict the date of the next eruption, but it will likely occur within the next several hundred years. If Mt. Shasta were to erupt, lava flows, pyroclastic flows, and mud flows could adversely affect and cause destruction of airport facilities.

Flood Plains

The Federal Emergency Management Agency (FEMA) has identified the site as lying in unshaded Zone X, or outside the limits of a 500-year flood plain (FEMA, 2011).

Other Geologic Hazards

A moderate to high potential for dust generation is present if subgrade preparation is performed in dry weather. No other geologic hazards were identified.



Discussion and Recommendations

General Information

The project will involve the design and reconstruction of an asphalt concrete taxiway and aircraft parking apron at the Weed Airport in Siskiyou County, California. Final reconstruction limits and design details were not available at the time of this report. It is expected entire main taxiway, the entire aircraft parking apron within the southwestern limit of the airport, and several other short taxiways that lead from the main taxiway will be reconstructed. The project design will be performed in accordance with the FAA requirements, specifically FAA Advisory Circular No. 150/5320-6G (FAA, 2021). The materials specifications for the project construction will be in accordance with FAA Advisory Circular No. 150/5370-10H (FAA, 2018).

The existing structural sections within the project area consists of 1.5 to 3 inches of asphalt concrete underlain by about 6.5 to 11 inches aggregate base. The subgrade materials associated with the existing pavement are mostly silty sand with gravel soils exhibiting less than 20 percent of non-plastic to low plasticity fines and are considered non-cohesive soils per the FAA guidelines. Existing subgrade soils exhibit low to moderate CBR values; based on the laboratory testing, a design CBR value of 10 may be utilized in the airport pavement design. Based on the pavement design by KH, the structural section for the new pavement will consist of asphalt concrete underlain by a recycled asphalt aggregate base generated from pulverization of existing pavement structural section.

The recommendations provided herein are intended to minimize risks of structural distress related to consolidation or expansion of native soils and/or structural fills. These recommendations, along with proper design and construction of the proposed structural improvements, work together as a system to improve overall performance. If any aspect of this system is ignored or is poorly implemented, the performance of the project will suffer. Sufficient quality control should be performed to verify that the recommendations presented in this report are followed.

Structural areas referred to in this report include all areas within the footprint of the proposed reconstruction, including asphalt concrete pavements and any adjacent shoulders. Based on the design aircraft weight, compaction requirements presented in this report are relative to ASTM D 698, except for P-207 recycled asphalt aggregate base course that requires compaction relative to ASTM D 1557 per FAA Advisory Circular No. 150/5370-10H (FAA, 2018). As noted above, onsite subgrade materials are exclusively non-cohesive soils exhibiting less than 50 percent by weight passing number 200 sieve and a plasticity index lower than 3.

Any evaluation of the site for the presence of surface or subsurface hazardous substances is beyond the scope of this investigation. When suspected hazardous substances are encountered during routine



geotechnical investigations, they are noted in the exploration logs and immediately reported to the client. No such substances were revealed during our exploration. However, our scope included the task to complete hydrocarbon testing on the subgrade soil sample collected from the pavement area near existing fueling station of the airport; the results from these chemical tests are presented in Appendix A for evaluation by others.

Subgrade Preparation, Compaction and Stabilization

Site/Subgrade Preparation and Compaction

The existing pavement in improvement areas shall be removed either by pulverizing or simply by heavy equipment. An average pulverization depth of 10 inches should be appropriate. The pulverized asphalt concrete and aggregate base blend may be reused as recycled asphalt aggregate base provided it meets the specifications for P-207 recycled asphalt aggregate base. If pulverized material does not meet the requirements for P-207 recycled asphalt aggregate base, it may be reused as P-154 subbase material to backfill any over-excavation of as part of stabilization discussed later in this section.

Aggregate base and subbase materials shall be placed in maximum 8-thick-loose lifts, moisture conditioned to within 2 percent of optimum moisture content, and compacted according to the recommendations set forth in Table 4 (Compaction Requirements). Subgrade soils shall also be scarified through 12 inches, moisture conditioned to within 2 percent of optimum moisture content, and compacted in place per Table 4.

TABLE 4 - COMPACTION REQUIREMENTS

Material Type	Minimum Relative Compaction (Percent)
P-207 Recycled Asphalt Aggregate Base	95 ¹
P-208 Aggregate Base (if utilized)	100 ²
P-154 Subbase (if utilized as stabilizing fill)	100 ²
Subgrade Soils	95 ^{2, 3}

¹ ASTM D 1557 Modified Proctor

² ASTM D 698 Standard Proctor

³ Alternatively, subgrade soils may be densified to at least 92 percent relative compaction as determined per ASTM D 1557.

The recommended compaction for various materials in Table 4 will generally meet the compaction requirements through various depths recommended in the FAARFIELD design program. It is noted that P-207 recycled asphalt aggregate base will require densification to at least 95 percent relative compaction, as determined by ASTM D 1557, per the requirements of the FAA Standard Specifications for Construction of Airports AC 150/5570-10H (FAA, 2018). If desired for a uniform project specification, P-209 aggregate base



and P-154 subbase material can alternatively be densified to at least 95 percent relative compaction, as determined per ASTM D 1557.

Where exposed, the subgrade should be densified to 95 percent relative compaction (ASTM D 698), proof rolled with a heavily loaded, pneumatic tired vehicle, and checked for moisture and stability. Areas that are unstable or exhibit excessive deflection during proof rolling should be excavated and replaced and/or stabilized per the later recommendations in this section.

Where full-depth reclamation and pulverization is utilized and if it is feasible to slightly raise the grade, the pulverized material may be compacted in place to meet the above-listed compaction specifications. However, test sections will be necessary to evaluate the level of compaction with depth. In most cases, removal/flip-flop of pulverized material will likely be necessary to expose the subgrade soils and compact the grade to the required level of compaction.

Stabilization

If wet weather construction is anticipated, the subgrade soils may be well above optimum moisture and very difficult to compact. Furthermore, over-optimum subgrade soils beneath existing pavement may be encountered, particularly in locations of poor drainage. Even with a pulverization option where subgrade is not exposed, there are localized areas with moisture sensitive clay rich subgrade soils (as encountered in boring B-08) and these soils may become unstable with construction vehicle traffic and may demand stabilization. However, these areas should be of limited extent and most subgrade soils are granular non-cohesive materials that should exhibit stability. In some situations, moisture conditioning may be possible by scarifying the top 12 inches of subgrade and allowing it to air-dry to near-optimum moisture prior to compaction. Where this procedure is ineffective or where construction schedules preclude delays, mechanical stabilization will be necessary.

Mechanical stabilization should generally be possible at the site via over-excavating the unstable subgrade soils and replacing with a compacted stabilizing fill section. A subbase material that meets the specifications of P-154 (FAA, 2018) is appropriate for stabilizing fill. Removal of unstable, wet soils should extend a minimum depth of 12 inches. Additional depth of removal may be necessary based on the conditions and stability of the exposed subgrade at the bottom of the over-excavation. Removal beyond a depth of 18 inches is not generally expected. A woven or nonwoven separation geotextile should be placed at the over-excavation grade prior to backfilling with subbase material. The geotextile shall meet the mechanical properties requirements for a Class 2 geotextile (American Association of State Highway and Transportation Officials, 2017) and shall exhibit a minimum permeability of 0.02 sec^{-1} per ASTM D4491 and a maximum apparent opening size of 0.60 millimeters per ASTM D4751. The subgrade should be levelled and lightly compacted using static compaction with a smooth drum roller compactor to receive stabilizing fill. The stabilizing fill should be placed in no more than 12-inch-thick, loose lifts each densified to relative compaction specifications provided earlier in Table 4. A geotextile such as Mirafi® 600X will meet the above-recommended specifications.



As an alternate stabilization method, the contractor may propose cement treatment of subgrade soils to achieve a stable subgrade. In this case, a mix design should be performed to determine the required percentage of cement. For this alternate, we recommend the cement treatment be extended a minimum depth of 8 inches from the subgrade elevation and the cement treated subgrade exhibit a minimum 7-day unconfined compressive strength of 300 pounds per square inch. Based on the granular soil conditions, we anticipate the required compressive strength for the cement treated subgrade can be achieved with about 5 to 8 percent cement (based on the dry unit weight of subgrade soils).

Subgrade instability is a function of subgrade soil type and their moisture content. It is difficult to predict the extend of exposed subgrade areas requiring stabilization. Our exploration indicates some subgrade soils to exhibit somewhat elevated fines and relatively high moisture levels. For project planning and budget purpose, we recommend a minimum of 15 percent of the total subgrade area be assumed to require stabilization via removal through at least 12 inches depth and replacement with stabilizing fill underlain by a separation geotextile or stabilization via cement treated subgrade.

Trenching and Utility Backfill

The project may include some utility improvements requiring trenching and utility backfill. Temporary trenches with near-vertical sidewalls should be stable to a depth of approximately 4 feet. Temporary trenches are defined as those that will be open for less than 24 hours. Excavations to greater depths will require shoring or laying back of sidewalls to maintain adequate stability. Regulations contained in Part 1926, Subpart P, of Title 29 of the Code of Federal Regulations (2010) require that temporary sidewall slopes be no greater than those presented in Table 5 (Maximum Allowable Temporary Slopes).

TABLE 5 - MAXIMUM ALLOWABLE TEMPORARY SLOPES	
Soil or Rock Type	Maximum Allowable Slopes ¹ for Deep Excavations less than 20 Feet Deep ²
Stable Rock	Vertical (90 degrees)
Type A ³	3H:4V (53 degrees)
Type B	1H:1V (45 degrees)
Type C	3H:2V (34 degrees)
Notes:	

¹ Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

² Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

³ A short-term (open 24 hours or less) maximum allowable slope of 1H:2V (63 degrees) is allowed in excavation in Type A soils that are 12 feet or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet in depth shall be 3H:4V (53 degrees).

The State of California, Department of Industrial Relations, Division of Occupational Safer and Health (Cal/OSHA) has adopted and strictly enforces these regulations, including the classification system and the



maximum slopes. In general, Type A soils are cohesive, non-fissured soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) or greater. Type B are cohesive soils with an unconfined compressive strength between 0.5 and 1.5 tsf. Type C soils have an unconfined compressive strength below 0.5 tsf. Numerous additional factors and exclusions are included in the formal definitions. The client, owner, design engineer, and contractor shall refer to Appendix A and B of Subpart P of the previously referenced Federal Register for complete definitions and requirements on sloping and benching of trench sidewalks. Appendices C through F of Subpart P apply to requirements and methodologies for shoring.

On the basis of our exploration, onsite soils are predominately Type C. All drenching shall be performed and stabilized in accordance with local, state, and Cal/OSHA standards.

The maximum panicle size in trench backfill shall be 4 inches. Bedding and initial backfill 12 inches over the pipe will require import and shall conform to the requirements of the utility having jurisdiction. Bedding and initial backfill shall be densified to at least 90 percent relative compaction. Imposed materials will be needed for final backfill in structural areas. Backfill shall be placed in maximum 8-inch-thick loose lifts that are compacted to a minimum of 90 percent relative compaction in all structural areas.

Trenching will be difficult where cobbles and boulders are present within the subgrade soils; such soils were encountered in the area of borings B-07 and B-08 during our exploration.

Design CBR

The design CBR for the structural section design shall be selected based on the CBR test results for various subgrade soils presented in this report (refer to Table 3) using a statistical evaluation. A design CBR based on the average CBR value minus one standard deviation is considered appropriate. We calculate a design CBR of 10 for the subgrade soils at the airport and is considered appropriate for the silty sand with gravel soils that was encountered in most of the borings in our exploration.

Frost Considerations

The existing subgrade soils consist primarily of silty sand with gravel soils with less than 10 percent of particles finer than 0.02 millimeters in size. This material corresponds to FAA frost group classification of FG-2, suggesting the subgrade will have low to moderate susceptibility to frost. The City of Mt. Shasta Building Department indicates a frost depth of 12 inches in the vicinity of the airport. Given the limited frost depth, we expect frost mitigation is not a design concern for the proposed airport pavements.

Erosion Control

There are no major cut or fill slopes planned for in the proposed pavement reconstruction project. Dust potential at this site will be moderate to high during dry periods. Temporary (during construction) and permanent (after construction) erosion control will be required for all disturbed areas. The contractor shall prevent dust from being generated during construction in compliance with all applicable city, county, state,



and federal regulations. The contractor shall submit an acceptable dust control plan to the governing entity prior to starting site preparation or earthwork. Project specifications should include an indemnification by the contractor of the owner and engineer for any dust generation during the construction period

To minimize erosion and downstream impacts to sedimentation from this site, best management practices with respect to stormwater discharge shall be implemented.

Site Drainage

Adequate surface drainage should be provided so moisture is directed away from the edge of any pavement. The bonding of water on finished grade or at the edge of pavement should be prevented by proper grading. It is recommended edge drains with impermeable geomembrane on the pavement side be installed where drainage features for collection of surface runoff are planned next to paved areas on the project.



Anticipated Construction Problems

Once the asphalt concrete is removed, soft, wet surface soils may make it difficult for construction equipment to travel and operate and will tend to rut and pump under construction traffic. When occurs, mechanical stabilization may be necessary.

Perched water was encountered during exploration just beneath the pavement structural section within the northern limits of the aircraft parking apron. Depending on the construction, these areas may warrant significant stabilization measures and other drainage controls for the pavement reconstruction.

Excavation and trenching will be difficult due to the presence of cobbles and boulders in the subgrade soils within the northern limits of aircraft parking lot and the taxiway extends north from the parking lot. Borings B-07 and B-08 advanced in this area encountered at shallow depths at about 2.5 to 5 feet below existing pavement surface. Therefore, oversize particles should be expected in this area from shallow depths. Neat line trenching will be difficult to impossible in this area.



Quality Control

All plans and specifications should be reviewed for conformance with this geotechnical report prior to submitting them to the governing agencies.

The recommendations presented in this report are based on the assumption that sufficient field testing and construction review will be provided during all phases of construction. We should review the final plans and specifications to check for conformance with the intent of our recommendations.

During construction, we should have the opportunity to provide sufficient on-site observation of preparation and grading, over-excavation, fill placement, foundation installation, and paving. These observations would allow us to verify that the geotechnical conditions are as anticipated, and that the contractor's work is in conformance with the approved plans and specifications.



Standard Limitations

This report has been prepared in accordance with generally accepted geotechnical practices. The analyses and recommendations submitted are based on field exploration performed at the locations shown on Plate 1. This report does not reflect soils variations that may become evident during the construction period, at which time re-evaluation of the recommendations may be necessary. We recommend our firm be retained to perform construction observation in all phases of the project related to geotechnical factors to ensure compliance with our recommendations.

This report has been produced to provide information allowing the architect or engineer to design the project. The client is responsible for distributing this report to all designers and contractors whose work is affected by geotechnical aspects. In the event there are changes in the design, location, or ownership of the project from the time this report is issued, recommendations should be reviewed and possibly modified by the engineer. If the engineer is not granted the opportunity to make this recommended review, he can assume no responsibility for misinterpretation or misapplication of his recommendations or their validity in the event changes have been made in the original design concept without his prior review. The engineer makes no other warranties, either express or implied, as to the professional advice provided under the terms of this agreement and included in this report.



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PLATES



NORTH
 SCALE: 1" ≈ 470'
 (ON 11"X17" PAPER)

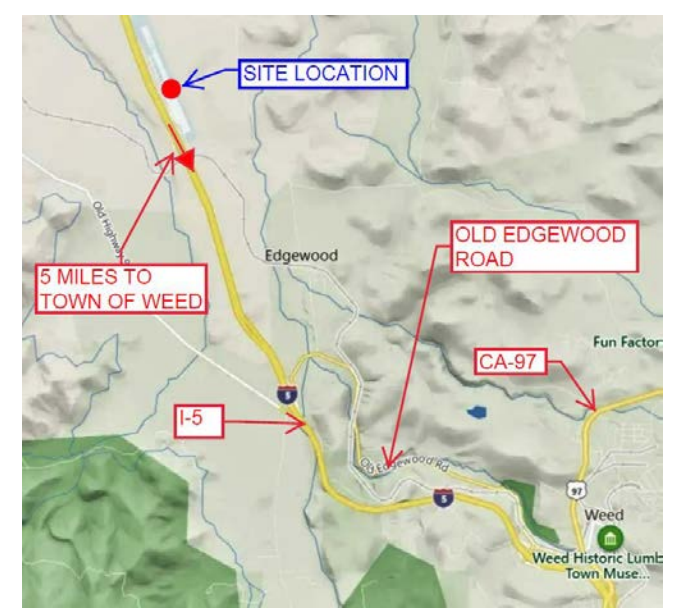
LEGEND

 **B-01** APPROXIMATE BORING LOCATION

NOTES

BASE MAP PROVIDED BY GOOGLE EARTH™

VICINITY MAP



NOT TO SCALE



KIMLEY-HORN AND ASSOCIATES, INC.
PLOT PLAN
 WEED AIRPORT TAXIWAY AND AIRCRAFT PARKING APRON
 SISKIYOU COUNTY, CALIFORNIA

Corestone Engineering, Inc.
 Project No. 5013-03-1



Corestone Engineering, Inc.
10751 Grayslake Dr
Reno, NV 89521
Telephone: 775-636-5916

LOG OF BORING NO. B-01

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/19/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
					Asphalt Concrete Approximately 2.75-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 11.25-inch-thick layer of aggregate base.
			GM		Base is described as brown, slightly moist, dense Silty Gravel with Sand with an estimated 20% non-plastic fines, 30% fine to coarse sand and 50% angular gravel up to 0.5" in diameter. Volcanic gravel base.
	MC A	41			Silty Sand with Gravel (Fill) Reddish brown, slightly moist, dense with 23% non-plastic fines, 49% fine to coarse sand and 28% angular gravel up to 1.5" in diameter.
2.5					Fill material. Material is likely sourced from native cut areas during the original grading.
					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
					<u>Laboratory Test Results for Combined Bulk Sample from Borings B-01 & B-02:</u> Moisture Content = 13.7%; Liquid Limit = No Value; Plasticity Index = Non Plastic; Maximum Dry Unit Weight = 119.5 pcf; Optimum Moisture Content = 7.5%; Specific Gravity = 2.63; CBR = 15.
	SPT B	29	SM		<u>Laboratory Test Results for Sample A:</u> Moisture Content = 6.3%; Dry Density = 113.6 pcf; Liquid Limit = No Value; Plasticity Index = Non Plastic.
5.0					
	SPT C	23	SC		Clayey Sand with Gravel Dark brown, moist, medium dense with an estimated 40% medium plasticity fines, 45% fine to coarse sand and 15% angular gravel up to 1" in diameter.
7.5					
			GM		Silty Gravel with Sand Gray, slightly moist, medium dense with an estimated 15% non-plastic fines, 30% fine to coarse sand and 55% angular gravel up to 1" in diameter.
	SPT D	47	SM		Silty Sand with Gravel Reddish brown, slightly moist, dense with an estimated 25% non-plastic fines, 40% fine to coarse sand and 35% angular gravel up to 0.75" in diameter.
10.0					

Bottom of borehole at 10.0 feet.



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10751 Grayslake Dr
Reno, NV 89521
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LOG OF BORING NO. B-02

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/19/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
					Asphalt Concrete Approximately 3-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 9.5-inch-thick layer of aggregate base.
			GM		Base is described as brown, slightly moist, dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 40% fine to coarse sand and 45% angular gravel up to 0.5" in diameter. Volcanic gravel base.
	MC A	50/6"			Silty Sand with Gravel (Fill) Reddish brown, slightly moist, dense with 23% non-plastic fines, 49% fine to coarse sand and 28% angular gravel up to 1.5" in diameter.
					Fill material. Material is likely sourced from native cut areas during the original grading.
2.5					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
			SM		<u>Laboratory Test Results for Combined Bulk Sample from Borings B-01 & B-02:</u> Moisture Content = 13.7%; Liquid Limit = No Value; Plasticity Index = Non Plastic; Maximum Dry Unit Weight = 119.5 pcf; Optimum Moisture Content = 7.5%; Specific Gravity = 2.63; CBR = 15.
	SPT B	38			<u>Laboratory Test Results for Sample A:</u> Moisture Content = 7.5%; Dry Density = 107.2 pcf; Specific Gravity = 2.67; Liquid Limit = No Value; Plasticity Index = Non Plastic.
5.0					
	SPT C	60/7"	SC		Clayey Sand with Gravel Dark brown, moist, very dense with an estimated 35% medium plasticity fines, 50% fine to coarse sand and 15% angular gravel up to 0.75" in diameter.
					Soils profile includes up to 6-inch-thick Sandy Lean Clay with an estimated 65% medium plasticity fines at approximately 6 feet below existing asphalt concrete pavement surface.
7.5					Presence of cobbles and/or boulders indicated by drilling response from about 7 feet depth below asphalt concrete surface.
	SPT D	80/8"	SM		Silty Sand with Gravel Brown, gray, slightly moist, very dense with an estimated 20% non-plastic fines, 60% fine to coarse sand and 20% angular gravel up to 1" in diameter.

Cobbles and/or boulders are present within the subsurface soils based on the drilling response. Cobbles and boulders within subsurface soils are not completely revealed in boring exploration.
Bottom of borehole at 9.7 feet.



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LOG OF BORING NO. B-03

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/19/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
					Asphalt Concrete Approximately 2.25-inch-thick layer of asphalt concrete.
			GM		Aggregate Base Approximately 9.25-inch-thick layer of aggregate base.
					Base is described as reddish brown, slightly moist, very dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 25% fine to coarse sand and 60% subangular to angular gravel up to 0.5" in diameter. Volcanic gravel base.
	MC A	52	GM		Silty Gravel with Sand Reddish brown, slightly moist, very dense with 19% non-plastic fines, 40% fine to coarse sand and 41% angular gravel up to 2" in diameter.
2.5					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
					Laboratory Test Results for Sample A: Moisture Content = 0.9%; Dry Density = 120.0 pcf; Specific Gravity = 2.62; Liquid Limit = No Value; Plasticity Index = Non Plastic.
					Silty Sand with Gravel Light reddish brown, brown, slightly moist, very dense with an estimated 20% non-plastic fines, 65% fine to coarse sand and 15% angular fine gravel.
	SPT B	71	SM		
5.0					
					Silty Sand with Gravel Light reddish brown, brown, slightly moist, very dense with an estimated 25% non-plastic fines, 65% fine to coarse sand and 10% angular gravel up to 0.75" in diameter.
	SPT C	58	SM		
7.5					
	SPT D	75	SM		
10.0					

Bottom of borehole at 10.0 feet.



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LOG OF BORING NO. B-04

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/20/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
					Asphalt Concrete Approximately 2-inch-thick layer of asphalt concrete.
			GM		Aggregate Base Approximately 10-inch-thick layer of aggregate base.
	MC A	50/4"			Base is described as reddish brown, slightly moist, dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 35% fine to coarse sand and 50% subangular to angular gravel up to 0.5" in diameter. Volcanic gravel base.
			SM		Silty Sand with Gravel Brown, slightly moist, very dense with an estimated 13% non-plastic fines, 52% fine to coarse sand and 35% angular gravel up to 1" in diameter.
2.5					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
					<u>Laboratory Test Results for Sample A:</u> Moisture Content = 9.5%; Liquid Limit = No Value; Plasticity Index = Non Plastic.
	SPT B	30	SM		Silty Sand with Gravel Brown, slightly moist, medium dense with 25% non-plastic fines, 53% fine to coarse sand and 22% angular gravel up to 1" in diameter.
5.0					<u>Laboratory Test Results for Sample B:</u> Moisture Content = 10.8%; Liquid Limit = No Value; Plasticity Index = Non Plastic.
	SPT C	56	SC- SM		Silty, Clayey Sand with Gravel Brown, dark brown, slightly moist, very dense with an estimated 25% low plasticity fines, 60% fine to coarse sand and 15% angular gravel up to 0.75" in diameter.
7.5					
	SPT D	23	SM		Silty Sand with Gravel Brown, slightly moist, medium dense with an estimated 20% non-plastic to low plasticity fines, 55% fine to coarse sand and 25% angular gravel up to 1" in diameter.
10.0					

Bottom of borehole at 10.0 feet.



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LOG OF BORING NO. B-05

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/19/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

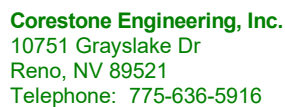
GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
					Asphalt Concrete Approximately 2.5-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 9-inch-thick layer of aggregate base.
			GM		Base is described as reddish brown, slightly moist, dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 35% fine to coarse sand and 50% subangular to angular gravel up to 0.5" in diameter. Volcanic gravel base.
	MC A	77			Silty Sand with Gravel Brown, black, slightly moist, very dense with 23% non-plastic fines, 49% fine to coarse sand and 28% subangular to angular gravel up to 1" in diameter.
2.5					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
					<u>Laboratory Test Results for Combined Bulk Sample from Borings B-05 & B-10:</u> Moisture Content = 7.3%; Liquid Limit = No Value; Plasticity Index = Non Plastic; Maximum Dry Unit Weight = 113.9 pcf; Optimum Moisture Content = 12.3%; Specific Gravity = 2.62; CBR = 9.
	SPT B	50/5"	SM		<u>Laboratory Test Results for Sample A:</u> Moisture Content = 16.6%; Dry Density = 101.9 pcf; Liquid Limit = No Value; Plasticity Index = Non Plastic.
5.0					
	SPT C	50/4"	SC		Clayey Sand with Gravel Brown, slightly moist, very dense with an estimated 25% low plasticity fines, 45% fine to coarse sand and 30% angular gravel up to 0.75" in diameter.
7.5					
	SPT D	96	SC-SM		Silty, Clayey Sand with Gravel Brown, slightly moist, very dense with an estimated 20% low plasticity fines, 45% fine to coarse sand and 35% angular gravel up to 0.75" in diameter.
10.0					

Bottom of borehole at 10.0 feet.

BORING LOG 5013031.GPJ Printed On: 1/17/22



PAGE 1 OF 1

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT LOCATION Siskiyou County, California

GROUND ELEVATION (FT) : NA

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

BOHRING LOG 5013031.GPJ Printed On:1/17/22

Bottom of borehole at 10.0 feet.



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LOG OF BORING NO. B-07

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

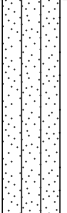
DATE : 10/20/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			GM		Asphalt Concrete Approximately 3-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 5.5-inch-thick layer of aggregate base.
	MC A	50/5.5"	GW- GM		Base is described as brown, moist, medium dense Silty Gravel with Sand with an estimated 15% low plasticity fines, 35% fine to coarse sand and 50% subangular to subrounded gravel up to 0.5" in diameter. Volcanic gravel base. Well Graded Gravel with Sand and Sandy Brown, moist, very dense with 11% low plasticity fines, 36% fine to coarse sand and 53% angular gravel up to 2" in diameter.
2.5					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface. <u>Laboratory Test Results for Sample A:</u> Moisture Content = 10.4%; Dry Density = 111.7 pcf; Specific Gravity = 2.62; Liquid Limit = 25; Plasticity Index = 2.
	SPT B	76	SM		Silty Sand with Gravel Brown, slightly moist, very dense with an estimated 15% non-plastic fines, 60% fine to coarse sand and 25% angular gravel up to 1" in diameter.
5.0					No sample recovery. SPT sampler tip broke due to driving into very dense soils profile. Soil classification based on bulk sample collected during drilling.

Boring terminated at 5 feet depth below existing asphalt concrete surface with very dense drilling and broken SPT sampler tip. Very dense soil profile based on drilling response.
Bottom of borehole at 5.0 feet.



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LOG OF BORING NO. B-08

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/20/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			GM		Asphalt Concrete Approximately 2.75-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 7.25-inch-thick layer of aggregate base.
					Base is described as brown, moist to wet, medium dense Silty Gravel with Sand with an estimated 15% non-plastic to low plasticity fines, 35% fine to coarse sand and 55% subangular to subrounded gravel up to 0.5" in diameter. Volcanic gravel base.
	MC A	21	GC		Clayey Gravel with Sand Dark brown, brown, moist to wet, medium dense with 30% medium plasticity fines, 38% fine to coarse sand and 42% angular gravel up to 2" in diameter.
2.5					Bulk sample collected from drill cuttings from 1 to 3 feet below existing asphalt concrete surface.
					<u>Laboratory Test Results for Sample A:</u> Moisture Content = 17.5%; Dry Density = 114.8 pcf; Liquid Limit = 31; Plasticity Index = 13.

Laboratory Test Results for Combined Bulk Sample from Borings B-08 & B-09: Moisture Content = 16.3%; Liquid Limit = No Value; Plasticity Index = Non Plastic; Maximum Dry Unit Weight = 124.2 pcf; Optimum Moisture Content = 9.7%; Specific Gravity = 2.66; CBR = 16.

First boring encountered drilling refusal on a boulder at 2 feet depth below asphalt concrete surface. Boring was offset 5 feet north of first location and encountered refusal on cobble and/or boulder at 3 feet depth below asphalt concrete surface.

Perched standing water (seepage) in the boring just beneath the structural section of the parking apron. Standing water is present in the adjacent drainage area east of the parking apron.

Standing water was not encountered in the second boring but the soils were moist to wet.

Cobbles and/or boulders are present within the subsurface soils based on the drilling response. Cobbles and boulders within subsurface soils are not completely revealed in boring exploration.
Bottom of borehole at 3.0 feet.



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LOG OF BORING NO. B-09

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/20/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
					Asphalt Concrete Approximately 2.75-inch-thick layer of asphalt concrete.
			GM		Aggregate Base Approximately 7.25-inch-thick layer of aggregate base.
					Base is described as brown, moist, medium dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 25% fine to coarse sand and 60% subangular to angular gravel up to 0.5" in diameter. Volcanic gravel base.
	MC A	80			Silty Sand with Gravel Dark brown, brown, moist, very dense with 17% non-plastic fine, 46% fine to coarse sand and 37% subangular to angular gravel up to 1.5" in diameter.
2.5					Bulk sample collected from drill cuttings from 1 to 3.5 feet below existing asphalt concrete surface.
			SM		<u>Laboratory Test Results for Sample A:</u> Moisture Content = 11.6%; Dry Density = 121.0 pcf; Specific Gravity = 2.59; Liquid Limit = No Value; Plasticity Index = Non Plastic.
	SPT B	50/6"			<u>Laboratory Test Results for Combined Bulk Sample from Borings B-08 & B-09:</u> Moisture Content = 16.3%; Liquid Limit = No Value; Plasticity Index = Non Plastic; Maximum Dry Unit Weight = 124.2 pcf; Optimum Moisture Content = 9.7%; Specific Gravity = 2.66; CBR = 16.
5.0					
			SM		Silty Sand with Gravel Light brown, slightly moist, very dense with an estimated 25% non-plastic fines, 60% fine to coarse sand and 15% angular gravel up to 0.5" in diameter.
	SPT C	50/4"			

Practical drilling refusal on possible cobble and/or boulder at about 6 feet depth below pavement surface.

Cobbles and/or boulders are present within the subsurface soils based on the drilling response. Cobbles and boulders within subsurface soils are not completely revealed in boring exploration.
Bottom of borehole at 6.0 feet.



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LOG OF BORING NO. B-10

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/20/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
					Asphalt Concrete Approximately 2.5-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 7.25-inch-thick layer of aggregate base.
			GM		Base is described as brown, moist, medium dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 25% fine to coarse sand and 60% subangular to angular gravel up to 0.5" in diameter. Volcanic gravel base.
	MC A	50/5"			Silty Sand with Gravel Brown, dark brown, slightly moist to moist, very dense with 18% non-plastic fines, 45% fine to coarse sand and 37% angular gravel up to 1" in diameter.
2.5					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
			SM		<u>Laboratory Test Results for Combined Bulk Sample from Borings B-05 & B-10:</u> Moisture Content = 7.3%; Liquid Limit = No Value; Plasticity Index = Non Plastic; Maximum Dry Unit Weight = 113.9 pcf; Optimum Moisture Content = 12.3%; Specific Gravity = 2.62; CBR = 9.
	SPT B	50/1"			<u>Laboratory Test Results for Sample A:</u> Moisture Content = 19.8%; Dry Density = 119.7 pcf; Specific Gravity = 2.63; Liquid Limit = 34; Plasticity Index = 14. Sample classified as Sandy Lean Clay with 50% medium plasticity fines.
5.0					
	SPT C	40			Silty Sand with Gravel Brown, gray, slightly moist, dense with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand and 25% angular gravel up to 1" in diameter.
7.5					
			SM		
	SPT D	34			
10.0					

First boring encountered refusal at 5 feet depth below asphalt concrete surface on very dense soils with possible cobble and/or boulder. Boring was offset 4 feet south of first location and drilled to 6 feet depth to continue SPT sampling and to achieve target 10 feet depth.

Cobbles and/or boulders are present within the subsurface soils based on the drilling response. Cobbles and boulders within subsurface soils are not completely revealed in boring exploration.
Bottom of borehole at 10.0 feet.

BORING LOG 5013031.GPJ Printed On: 1/17/22



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LOG OF BORING NO. B-11

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/20/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			GM		Asphalt Concrete Approximately 1.75-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 9.25-inch-thick layer of aggregate base.
	MC A	82/10.5"	SM		Base is described as reddish brown, slightly moist, dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 25% fine to coarse sand and 60% subangular to angular gravel up to 0.5" in diameter. Volcanic gravel base.
2.5					Silty Sand with Gravel Dark brown, brown, slightly moist, very dense with 21% low plasticity fines, 55% fine to coarse sand and 24% angular gravel up to 0.75" in diameter.
					Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
					<u>Laboratory Test Results for Sample A:</u> Moisture Content = 14.1%; Dry Density = 119.7 pcf; Specific Gravity = 2.65; Liquid Limit = 30; Plasticity Index = 2.
	SPT B	50/5"	SM		Silty Sand with Gravel Brown, slightly moist, very dense with an estimated 15% low plasticity fines, 50% fine to coarse sand and 35% angular gravel up to 0.75" in diameter.
5.0					
	SPT C	50/3.5"	SM		Silty Sand with Gravel Brown, slightly moist, very dense with an estimated 15% non-plastic to low plasticity fines, 65% fine to coarse sand and 20% angular gravel up to 0.75" in diameter.
7.5					
	SPT D	86/10"	SC-SM		Silty, Clayey Sand with Gravel Grayish brown, slightly moist, very dense with an estimated 15% low plasticity fines, 50% fine to coarse sand and 35% angular gravel up to 0.75" in diameter.

Hard drilling condition in very dense soils though the entire depth of boring.
Bottom of borehole at 9.8 feet.



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LOG OF BORING NO. B-12

PAGE 1 OF 1

CLIENT Kimley-Horn and Associates, Inc.

PROJECT NAME Weed Airport Taxiway and Aircraft Parking

PROJECT NUMBER 5013-03-1

PROJECT LOCATION Siskiyou County, California

DATE : 10/20/21

GROUND ELEVATION (FT) : NA

EQUIPMENT : CME 45

GROUNDWATER DEPTH (FT) : NE

LOGGED BY : PV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOWS/12"	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			GM		Asphalt Concrete Approximately 1.5-inch-thick layer of asphalt concrete.
					Aggregate Base Approximately 6.5-inch-thick layer of aggregate base.
	MC A	50/4"			Base is described as reddish brown, slightly moist, dense Silty Gravel with Sand with an estimated 15% non-plastic fines, 25% fine to coarse sand and 60% subangular to angular gravel up to 0.5" in diameter. Volcanic gravel base.
2.5			SP- SM		Poorly Graded Sand with Silt and Gravel Dark brown, brown, slightly moist, very dense with 12% non-plastic fines, 52% fine to coarse sand and 36% angular gravel up to 1" in diameter.
	SPT B	50/4"			Bulk sample collected from drill cuttings from 1 to 4 feet below existing asphalt concrete surface.
5.0					<u>Laboratory Test Results for Sample A:</u> Moisture Content = 11.6%; Liquid Limit = No Value; Plasticity Index = Non Plastic.
	SPT C	35			
7.5					Silty Gravel with Sand Dark gray, brown, orange brown, slightly moist, dense to very dense with an estimated 10-15% non-plastic fines, 40% fine to coarse sand and 45-50% angular gravel up to 1" in diameter.
			GM		
	SPT D	59			
10.0					

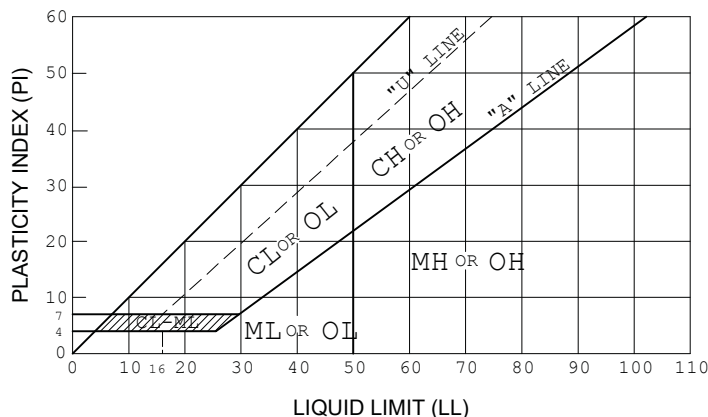
Hard drilling condition in very dense soils within upper 5 feet depth of boring.
Bottom of borehole at 10.0 feet.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS	TYPICAL DESCRIPTIONS				
			GRAPH LETTER					
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES			
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES			
				GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES			
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES			
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES			
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES			
				SM	SILTY SANDS, SAND - SILT MIXTURES			
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES			
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY			
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS			
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY			
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS			
				CH	INORGANIC CLAYS OF HIGH PLASTICITY			
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS			
			HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS
			FILL MATERIAL				--	FILL MATERIAL, NON-NATIVE

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.
SYMBOL COLORS ARE NOT SHOWN IN THE GRAPHIC DISPLAY

PLASTICITY CHART



FOR CLASSIFICATION OF FINE-GRAINED SOILS AND FINE-GRAINED FRACTION OF COARSE-GRAINED SOILS

EXPLORATION SAMPLE TERMINOLOGY

Sample Type	Sample Symbol	Sample Code
Auger Cuttings		Auger
Bulk (Grab) Sample		Grab
Modified California Sampler		MC
Shelby Tube		SH or ST
Standard Penetration Test		SPT
Split Spoon		SS
No Sample		

GRAIN SIZE TERMINOLOGY

Component of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 2mm)
Sand	#4 to #200 sieve (2mm to 0.074mm)
Silt or Clay	Passing #200 sieve (0.074mm)

RELATIVE DENSITY OF GRANULAR SOILS

N - Blows/ft	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
greater than 50	Very Dense

CONSISTENCY OF COHESIVE SOILS

Unconfined Compressive Strength, psf	N - Blows/ft	Consistency
less than 500	0 - 1	Very Soft
500 - 1,000	2 - 4	Soft
1,000 - 2,000	5 - 8	Firm
2,000 - 4,000	9 - 15	Stiff
4,000 - 8,000	16 - 30	Very Stiff
8,000 - 16,000	31 - 60	Hard
greater than 16,000	greater than 60	Very Hard



Corestone Engineering, Inc.
10751 Grayslake Dr
Reno, NV 89521
Ph. (775) 636-5916

USCS Soil Classification Chart

Project: **Weed Airport Taxiway and Parking Apron**

Location: **Siskiyou County, California**

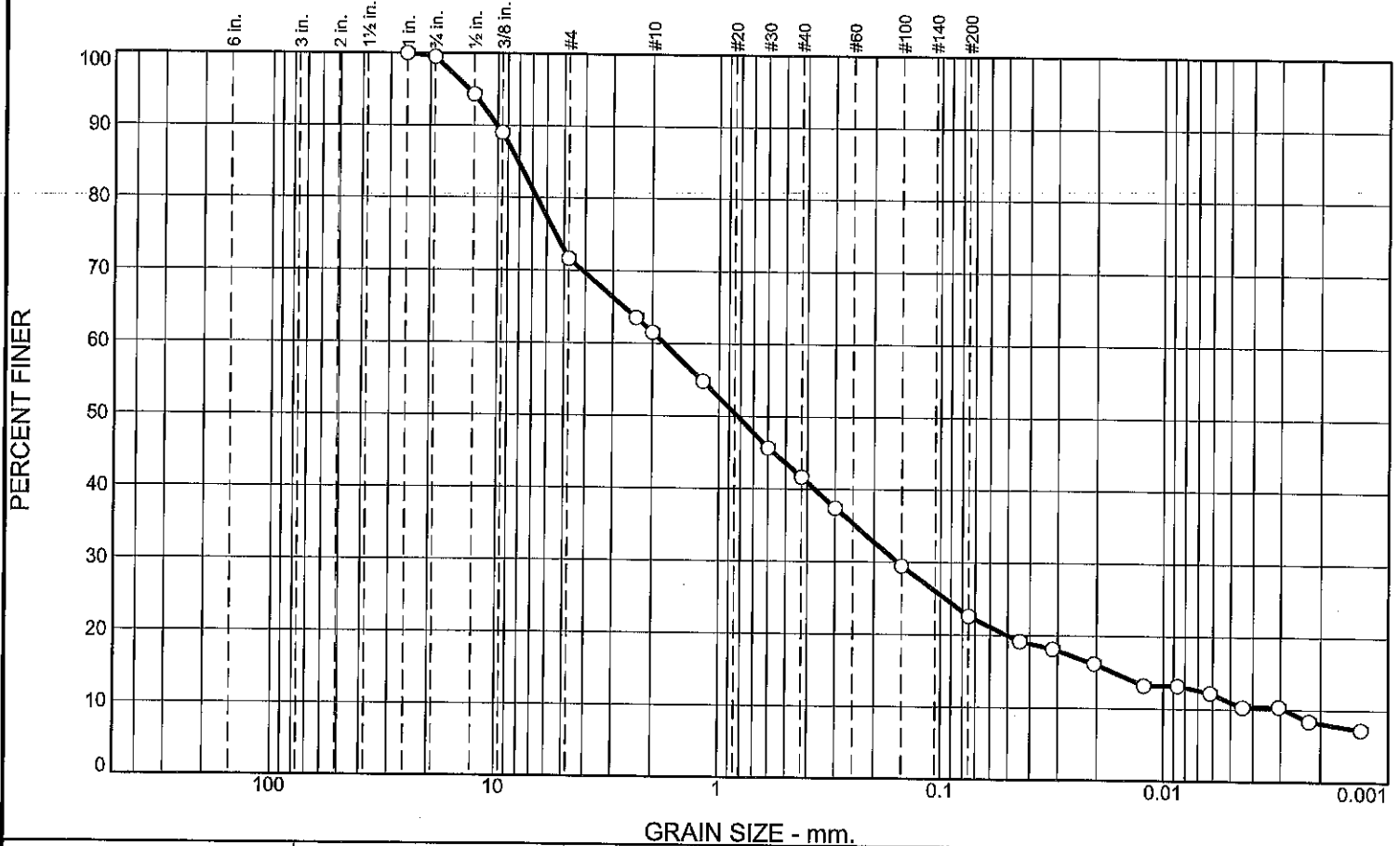
Project Number: **5013-03-1**

Plate 3

APPENDIX A

INDEX TEST RESULTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	28	10	20	19	12	11

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100		
.75	100		
.5	94		
.375	89		
#4	72		
#8	64		
#10	62		
#16	55		
#30	46		
#40	42		
#50	37		
#100	29		
#200	23		
0.0442 mm.	19		
0.0316 mm.	18		
0.0205 mm.	16		
0.0122 mm.	13		
0.0086 mm.	13		
0.0062 mm.	12		
0.0044 mm.	10		
0.0031 mm.	10		
0.0022 mm.	8.4		
0.0013 mm.	7.3		

* (no specification provided)

Soil Description

Silty sand with gravel

Atterberg Limits

PL= NP

LL= NV

PI= NP

Coefficients

D₉₀= 10.0522

D₈₅= 8.1133

D₆₀= 1.7722

D₅₀= 0.8262

D₃₀= 0.1572

D₁₅= 0.0168

D₁₀= 0.0029

C_u= 613.21

C_c= 4.82

Classification

USCS= SM

AASHTO= A-1-b

Remarks

SAMPLED BY: CLIENT

SPECIFIC GRAVITY=2.63

Location: 5013-03-1/B-1 THRU B-2 BULK

Date: 12/14/21



**GEOTECHNICAL &
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SERVICES, INC.**

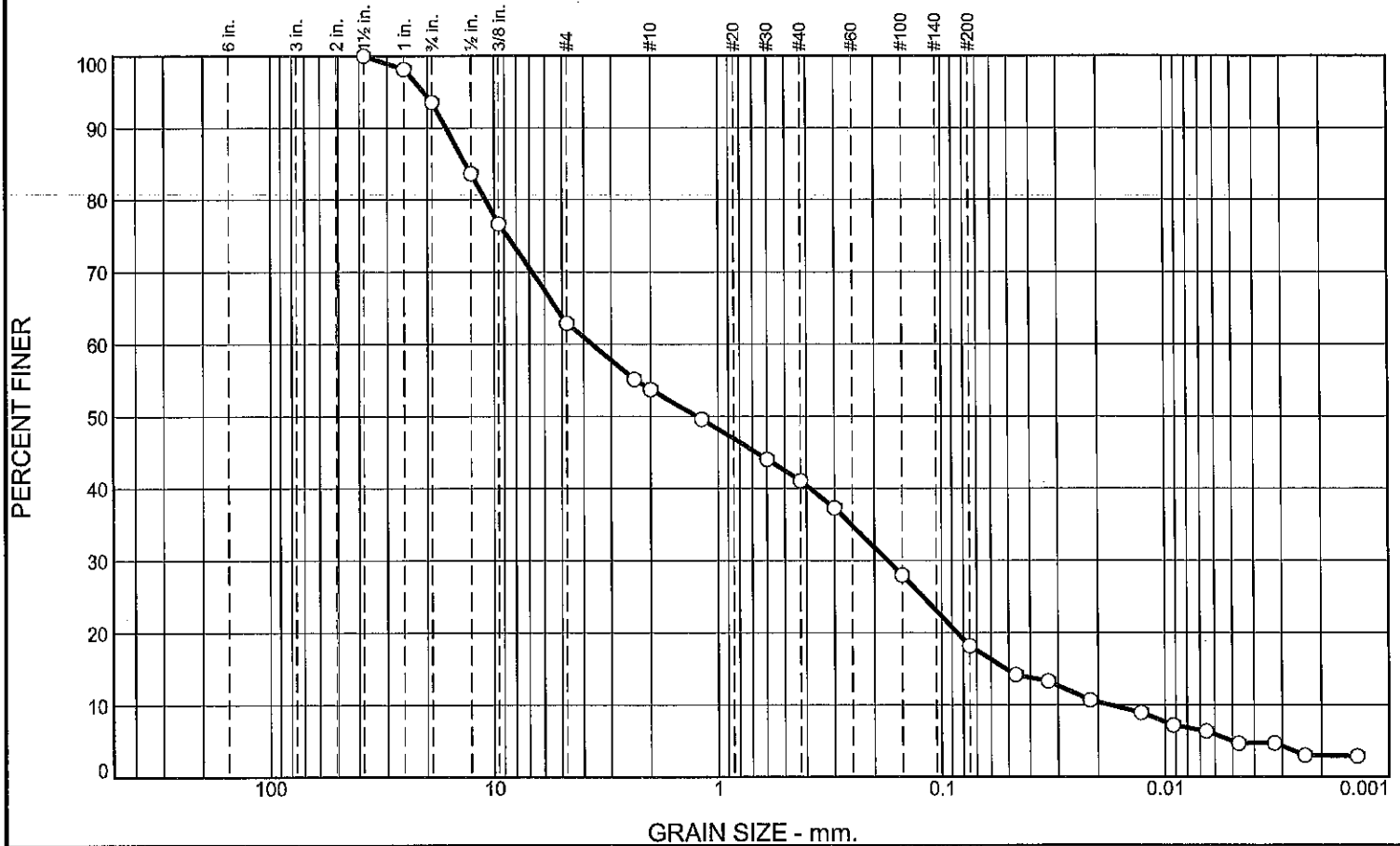
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: D. YOON

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	6	31	9	13	23	13	5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	98		
.75	94		
.5	84		
.375	77		
#4	63		
#8	55		
#10	54		
#16	50		
#30	44		
#40	41		
#50	37		
#100	28		
#200	18		
0.0464 mm.	14		
0.0332 mm.	13		
0.0217 mm.	11		
0.0128 mm.	8.9		
0.0092 mm.	7.2		
0.0066 mm.	6.3		
0.0047 mm.	4.7		
0.0032 mm.	4.7		
0.0024 mm.	3.0		
0.0014 mm.	2.9		

* (no specification provided)

Soil Description

Silty sand with gravel

Atterberg Limits

PL= NP

LL= NV

PI= NP

Coefficients

D₉₀= 16.4867

D₈₅= 13.4498

D₆₀= 3.6639

D₅₀= 1.2441

D₃₀= 0.1746

D₁₅= 0.0514

D₁₀= 0.0178

C_u= 205.70

C_c= 0.47

Classification

USCS= SM

AASHTO= A-1-b

Remarks

SAMPLED BY: CLIENT

SPECIFIC GRAVITY=2.62

Location: 5013-03-1/B-5 AND B-10 BULK

Date: 12/14/21



**GEOTECHNICAL &
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SERVICES, INC.**

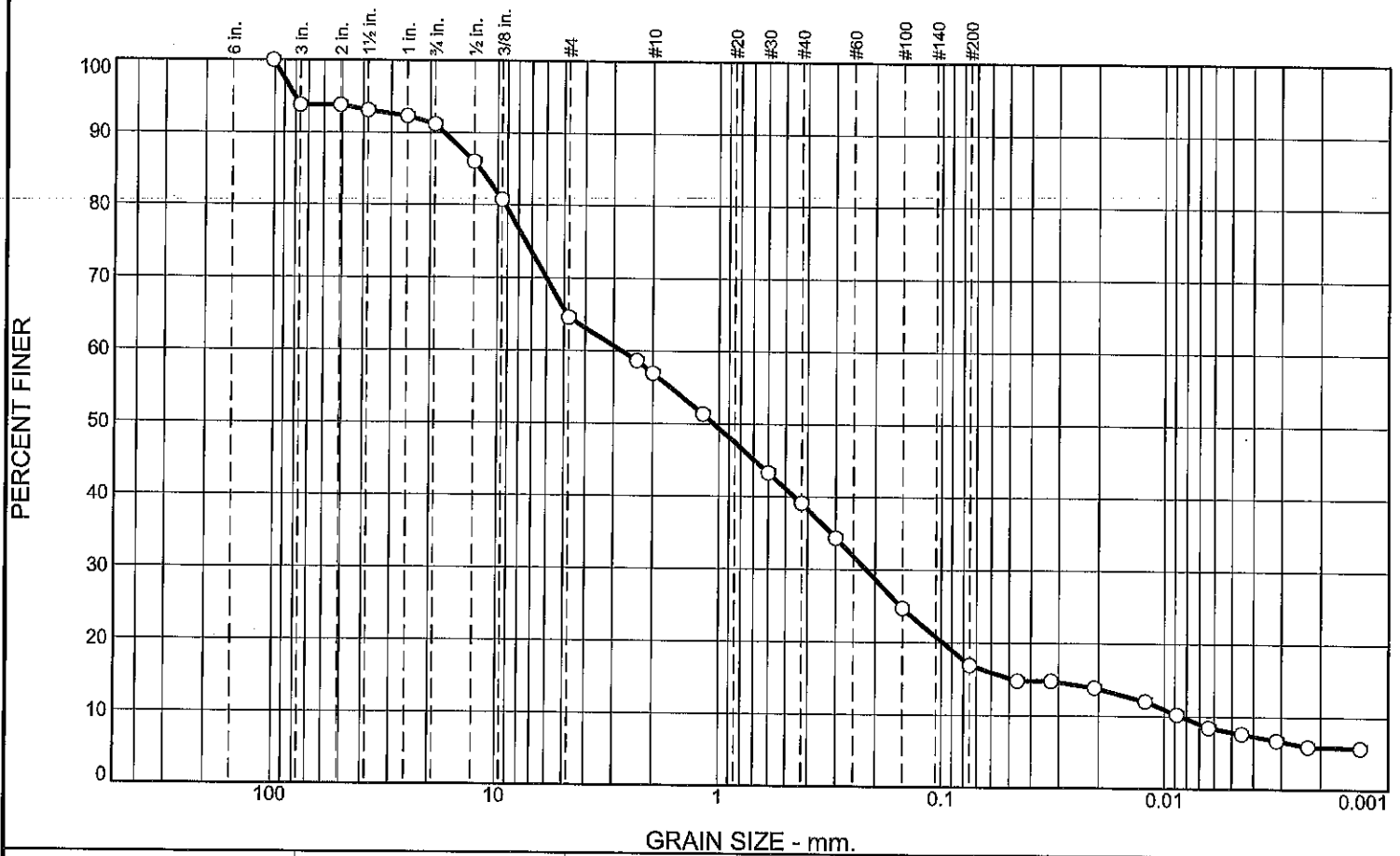
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: D. YOON

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
6	3	26	8	18	22	9	8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100		
3	94		
2	94		
1.5	93		
1	92		
.75	91		
.5	86		
.375	81		
#4	65		
#8	59		
#10	57		
#16	51		
#30	43		
#40	39		
#50	34		
#100	25		
#200	17		
0.0459 mm.	15		
0.0325 mm.	15		
0.0208 mm.	14		
0.0125 mm.	12		
0.0085 mm.	10		
0.0064 mm.	8.4		
0.0045 mm.	7.6		
0.0031 mm.	6.7		
0.0023 mm.	5.9		
0.0013 mm.	5.7		

* (no specification provided)

<u>Soil Description</u>		
Silty sand with gravel		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D ₉₀ = 17.3646	D ₈₅ = 11.9977	D ₆₀ = 2.7623
D ₅₀ = 1.0535	D ₃₀ = 0.2195	D ₁₅ = 0.0483
D ₁₀ = 0.0085	C _u = 326.08	C _c = 2.06
<u>Classification</u>		
USCS= SM	AASHTO= A-1-b	
<u>Remarks</u>		
SAMPLED BY: CLIENT		
SPECIFIC GRAVITY=2.66		

Location: 5013-03-1/B-8 THRU B-9 BULK

Date: 12/14/21



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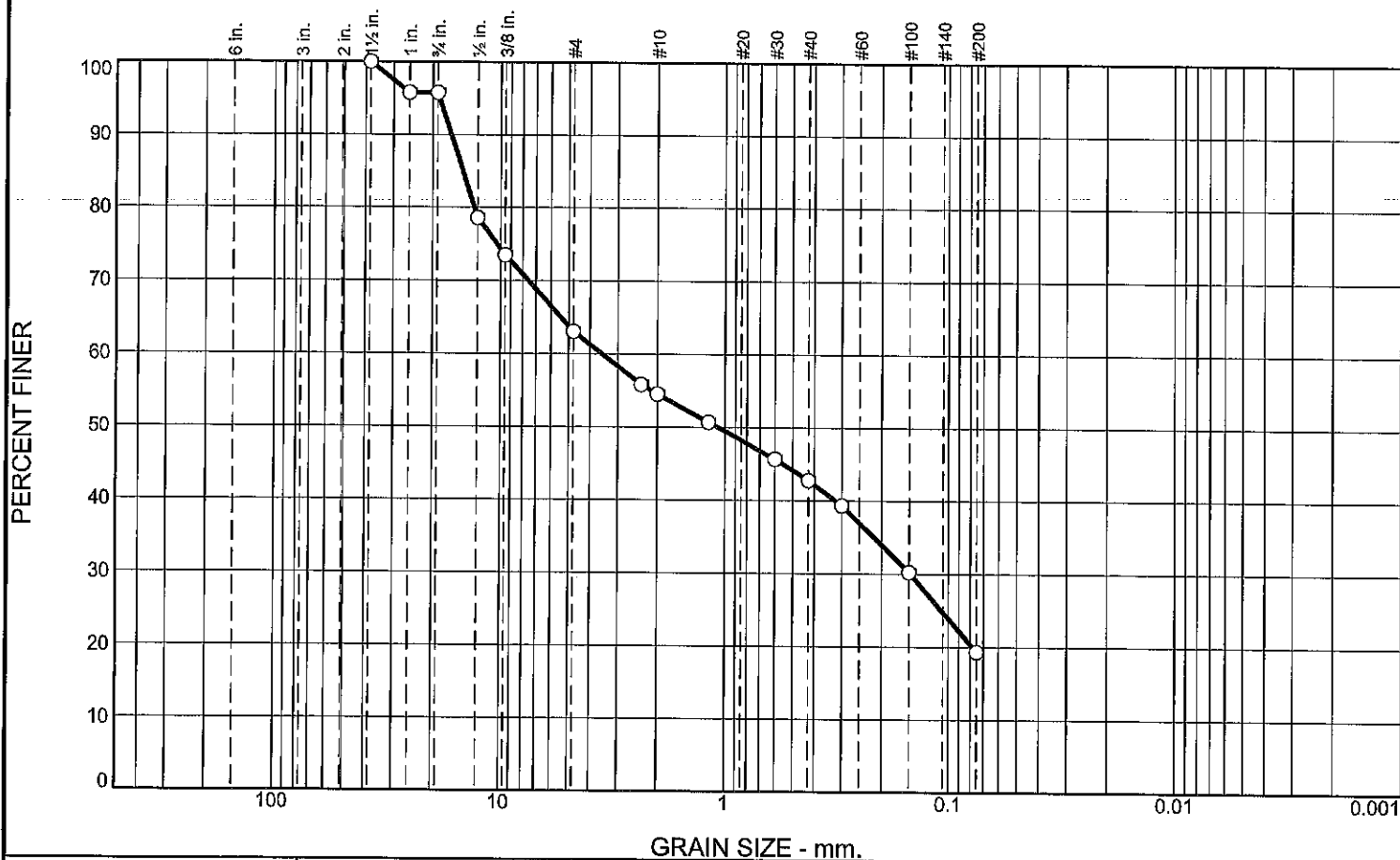
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: D. YOON

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	4	33	8	12	24	19	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	96		
.75	96		
.5	79		
.375	74		
#4	63		
#8	56		
#10	55		
#16	51		
#30	46		
#40	43		
#50	39		
#100	30		
#200	19		

* (no specification provided)

Soil Description		
silty sand with gravel		
Atterberg Limits		
PL= NP	LL= NV	PI= NP
Coefficients		
D ₉₀ = 16.6191	D ₈₅ = 14.7664	D ₆₀ = 3.5410
D ₅₀ = 1.0775	D ₃₀ = 0.1478	D ₁₅ =
D ₁₀ =	C _u =	C _c =
Classification		
USCS= SM	AASHTO= A-1-b	
Remarks		
SAMPLED BY: CLIENT		

Location: 5013-03-1/B-01 A 1.0'

Date: 12/14/21



**GEOTECHNICAL &
ENVIRONMENTAL
SERVICES, INC.**

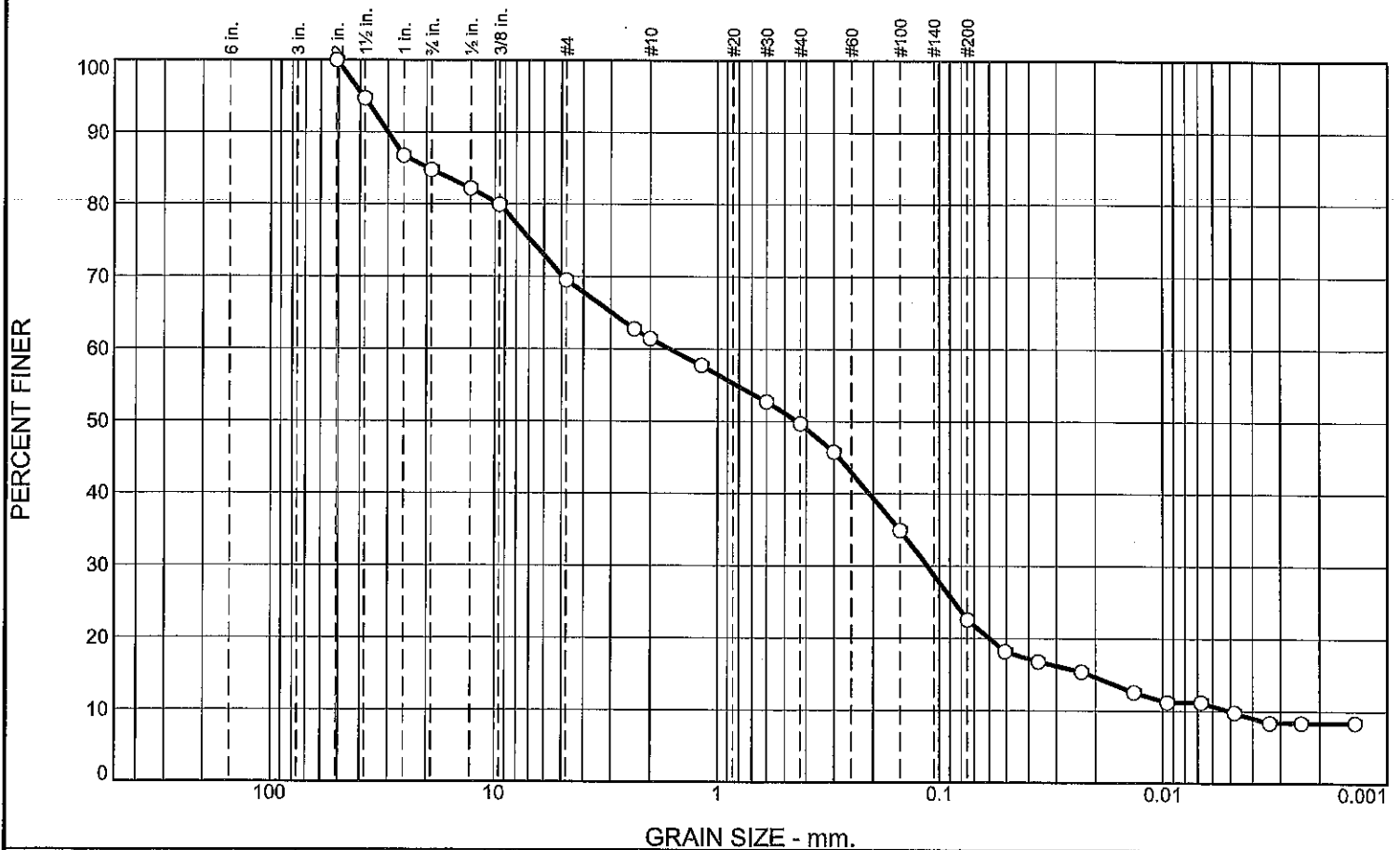
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	15	15	9	11	27	13	10

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100		
1.5	95		
1	87		
.75	85		
.5	82		
.375	80		
#4	70		
#8	63		
#10	61		
#16	58		
#30	53		
#40	50		
#50	46		
#100	35		
#200	23		
0.0509 mm.	18		
0.0362 mm.	17		
0.0230 mm.	15		
0.0134 mm.	13		
0.0096 mm.	11		
0.0068 mm.	11		
0.0048 mm.	9.8		
0.0033 mm.	8.4		
0.0024 mm.	8.4		
0.0014 mm.	8.4		

* (no specification provided)

<u>Soil Description</u>		
silty sand with gravel		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D ₉₀ = 29.9590	D ₈₅ = 19.6438	D ₆₀ = 1.6340
D ₅₀ = 0.4403	D ₃₀ = 0.1138	D ₁₅ = 0.0214
D ₁₀ = 0.0051	C _u = 321.09	C _c = 1.56
<u>Classification</u>		
USCS= SM	AASHTO= A-1-b	
<u>Remarks</u>		
SAMPLED BY: CLIENT		
SPECIFIC GRAVITY=2.67		

Location: 5013-03-1/B-02 A 1.0'

Date: 12/14/21



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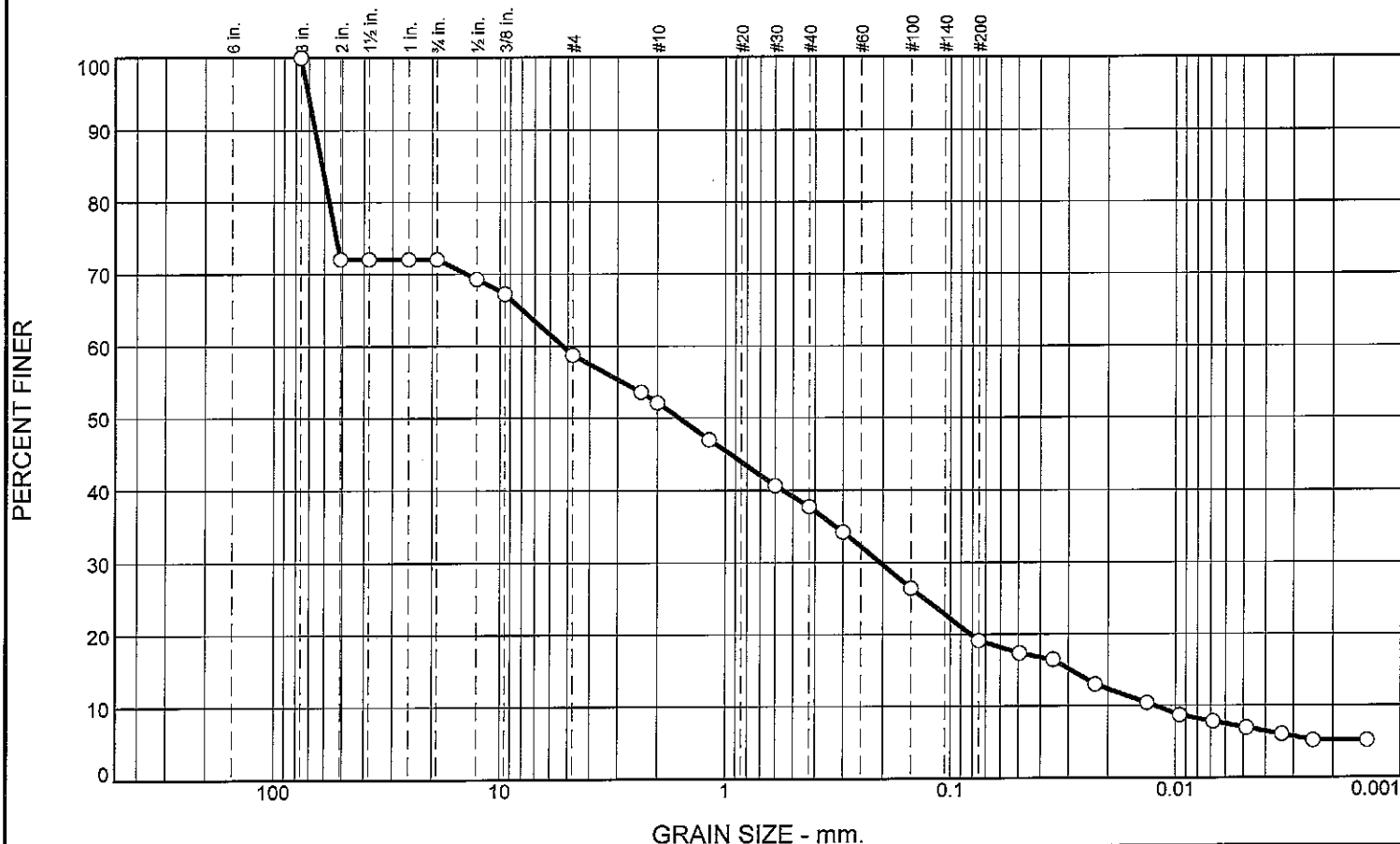
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	28	13	7	14	19	12	7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100		
2	72		
1.5	72		
1	72		
.75	72		
.5	69		
.375	67		
#4	59		
#8	54		
#10	52		
#16	47		
#30	41		
#40	38		
#50	34		
#100	26		
#200	19		
0.0495 mm.	17		
0.0352 mm.	16		
0.0228 mm.	13		
0.0134 mm.	10		
0.0096 mm.	8.7		
0.0068 mm.	7.8		
0.0048 mm.	6.9		
0.0034 mm.	6.0		
0.0025 mm.	5.2		
0.0014 mm.	5.2		

* (no specification provided)

Location: 5013-03-1/B-03 A 1.0'

Date: 12/14/21

<u>Soil Description</u>		
poorly graded sand with silt and gravel		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D ₉₀ = 65.9017	D ₈₅ = 61.2868	D ₆₀ = 5.2384
D ₅₀ = 1.6086	D ₃₀ = 0.2057	D ₁₅ = 0.0293
D ₁₀ = 0.0124	C _u = 421.07	C _c = 0.65
<u>Classification</u>		
USCS= GM	AASHTO= A-1-b	
<u>Remarks</u>		
SAMPLED BY: CLIENT		
SPECIFIC GRAVITY=2.62		



GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

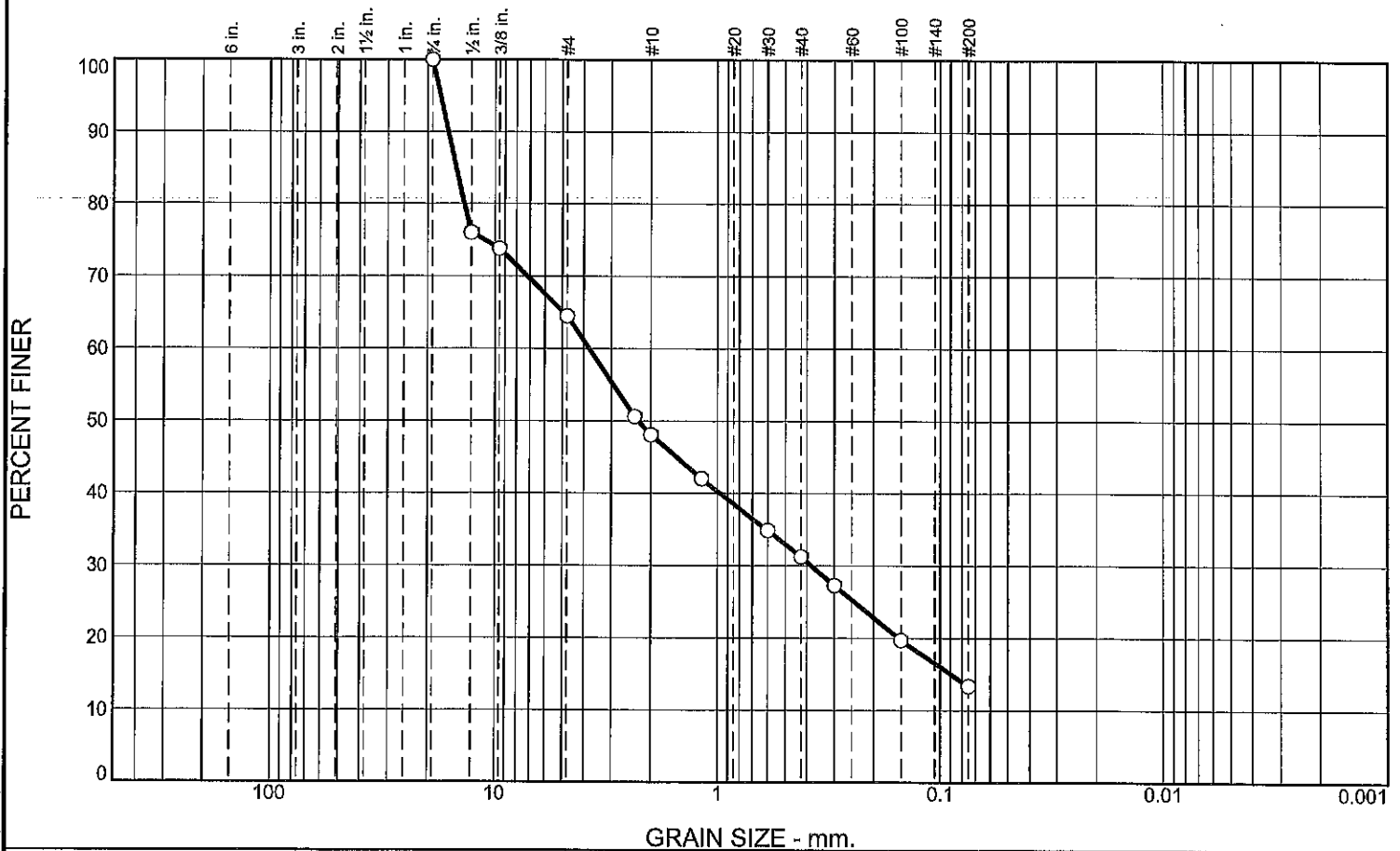
Client: Corestone Engineering
Project: Weed Airport Project

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	35	17	17	18	13	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100		
.5	76		
.375	74		
#4	65		
#8	51		
#10	48		
#16	42		
#30	35		
#40	31		
#50	27		
#100	20		
#200	13		

<u>Soil Description</u>		
silty sand with gravel		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D ₉₀ = 16.0854	D ₈₅ = 14.7808	D ₆₀ = 3.7877
D ₅₀ = 2.2700	D ₃₀ = 0.3814	D ₁₅ = 0.0896
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= SM	AASHTO= A-1-b	
<u>Remarks</u>		
SAMPLED BY: CLIENT		

* (no specification provided)

Location: 5013-03-1/B-04 A 1.0'

Date: 12/14/21



GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

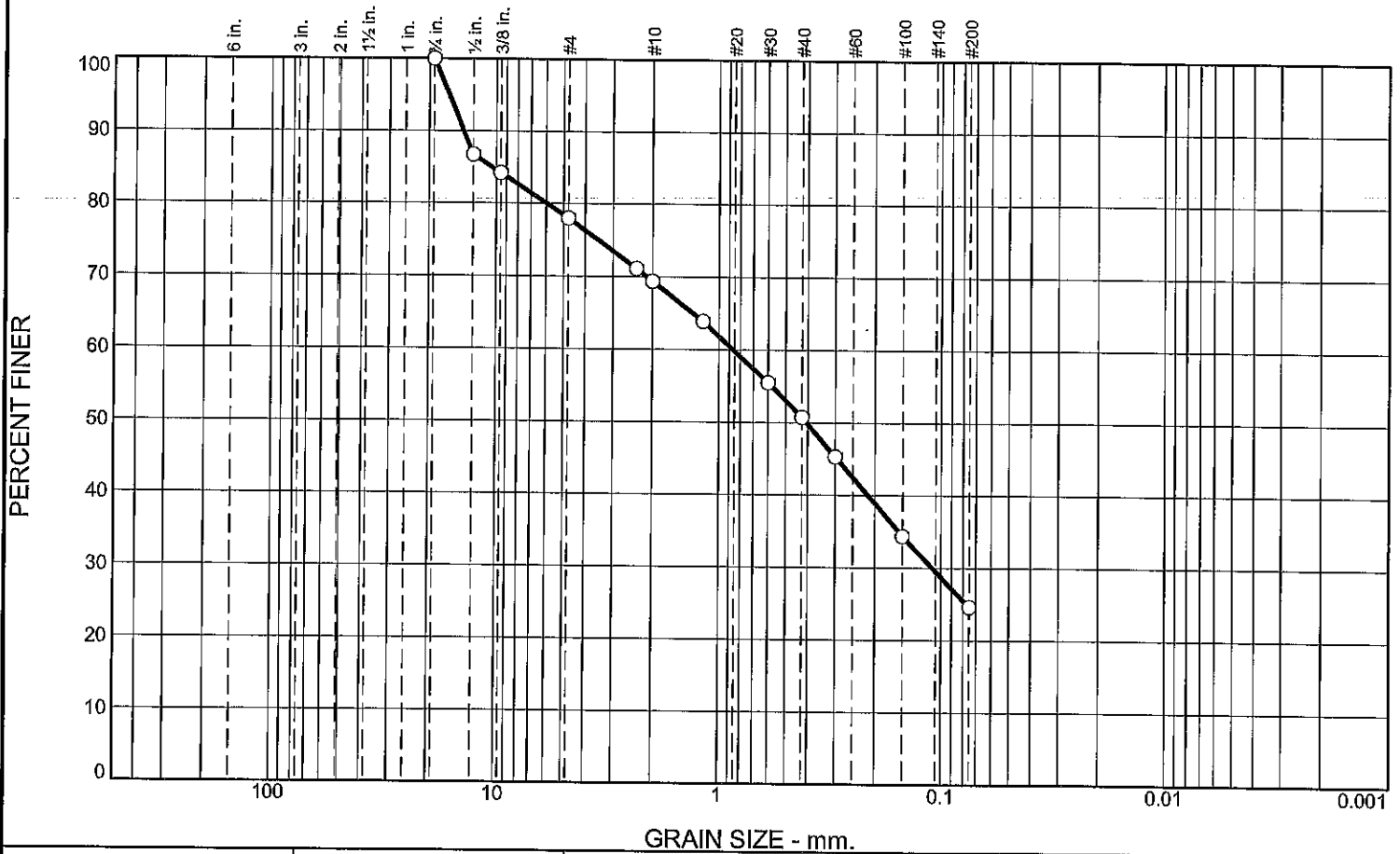
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	22	9	18	26	25	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100		
.5	87		
.375	84		
#4	78		
#8	71		
#10	69		
#16	64		
#30	55		
#40	51		
#50	45		
#100	34		
#200	25		

Soil Description
silty sand with gravel

Atterberg Limits
 PL= NP LL= NV PI= NP

Coefficients
 D₉₀= 14.0425 D₈₅= 10.4122 D₆₀= 0.8633
 D₅₀= 0.4054 D₃₀= 0.1098 D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= SM AASHTO= A-2-4(0)

Remarks
 SAMPLED BY: CLIENT

* (no specification provided)

Location: 5013-03-1/B-04 B 3.5'

Date: 12/14/21



GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

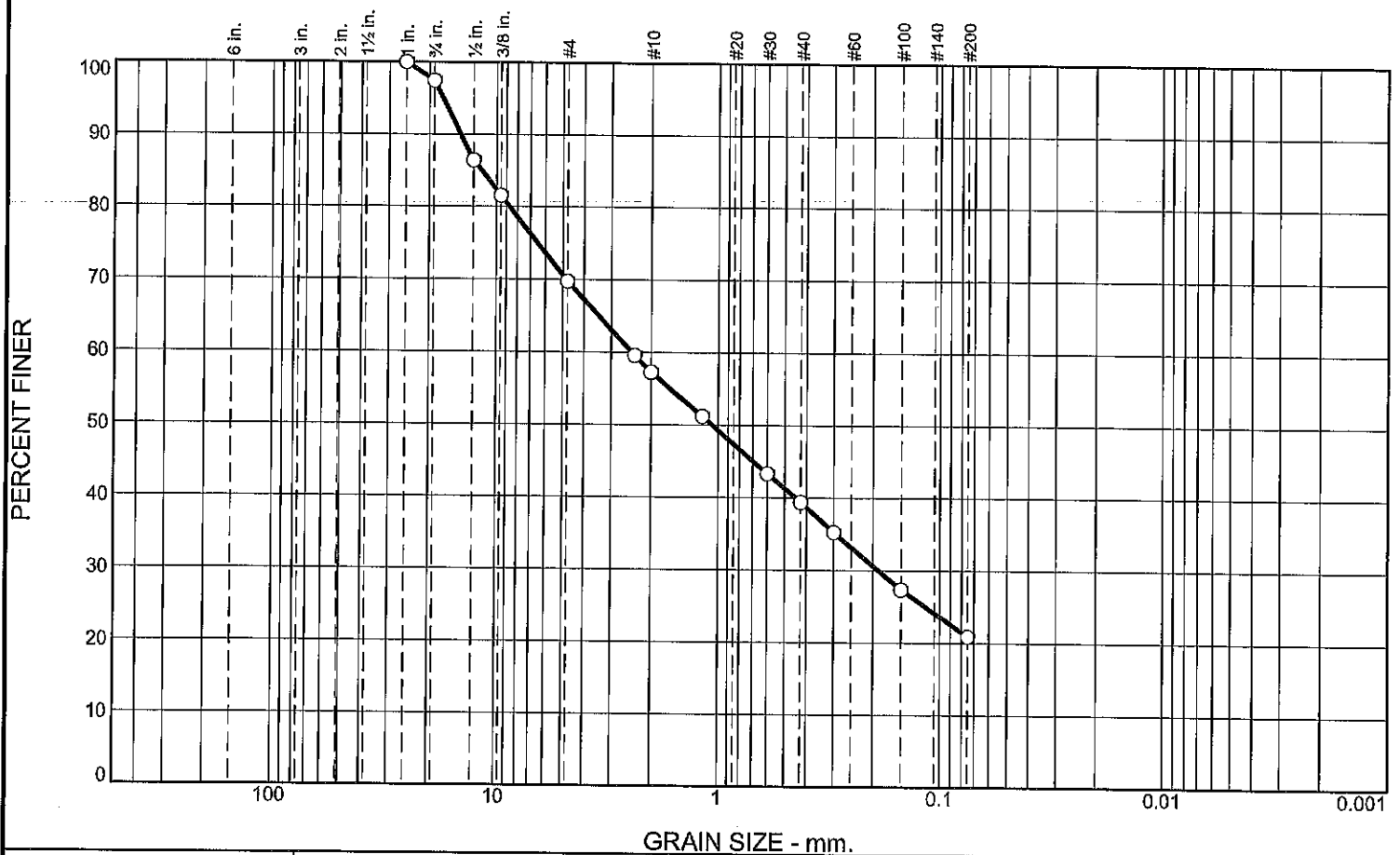
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	3	27	13	18	18	21	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100		
.75	97		
.5	86		
.375	82		
#4	70		
#8	60		
#10	57		
#16	51		
#30	43		
#40	39		
#50	35		
#100	27		
#200	21		

* (no specification provided)

Soil Description
 Silty sand with gravel

Atterberg Limits
 PL= 23 LL= 23 PI= NP

Coefficients
 D₉₀= 14.4926 D₈₅= 11.6823 D₆₀= 2.4299
 D₅₀= 1.0674 D₃₀= 0.1891 D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= SM AASHTO= A-1-b

Remarks
 SAMPLED BY: CLIENT

Location: 5013-03-1/B-05 A 1.0'

Date: 12/14/21



GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

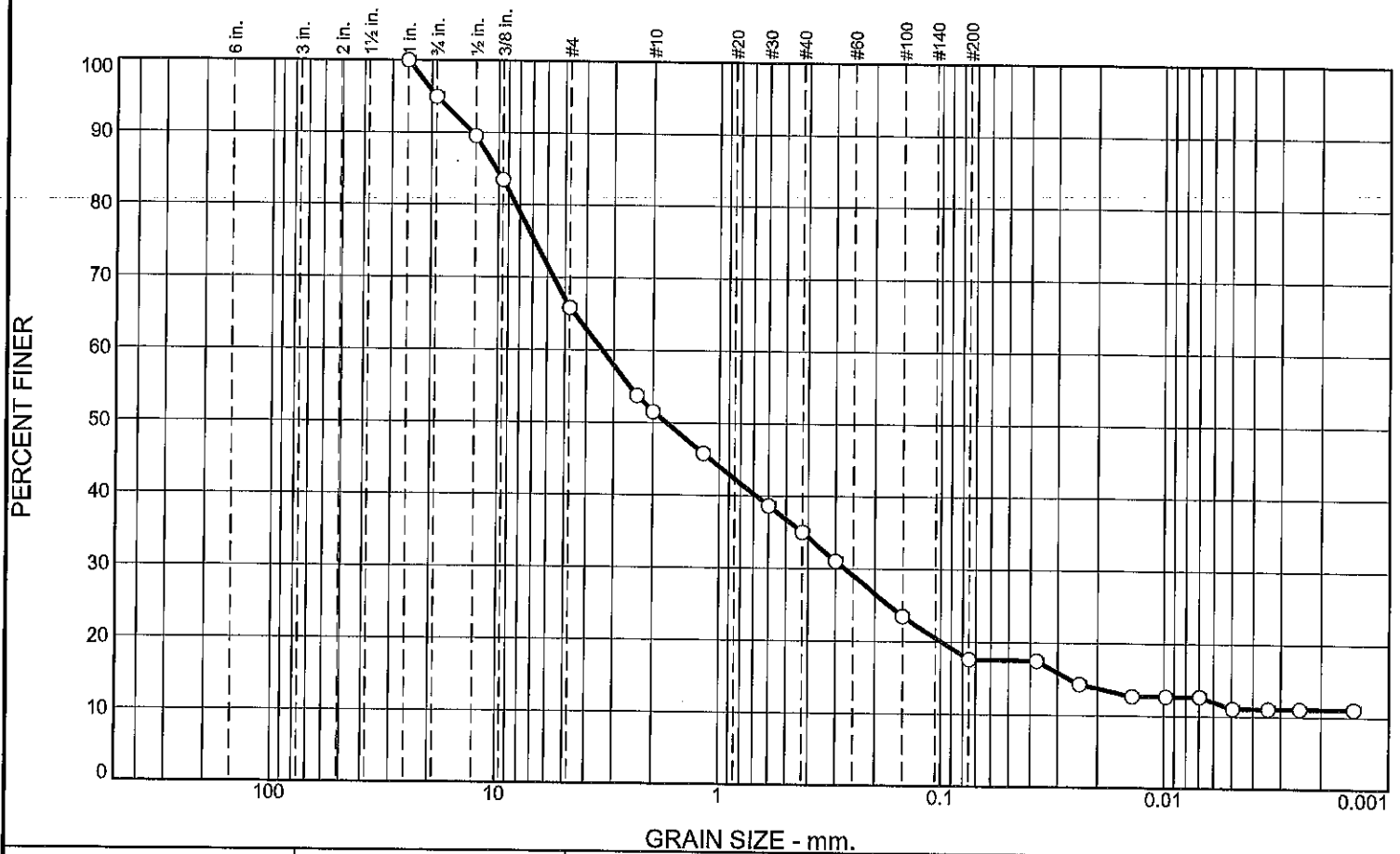
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	5	29	14	17	17	7	11

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100		
.75	95		
.5	90		
.375	83		
#4	66		
#8	54		
#10	52		
#16	46		
#30	39		
#40	35		
#50	31		
#100	23		
#200	18		
0.0375 mm.	17		
0.0239 mm.	14		
0.0139 mm.	13		
0.0098 mm.	13		
0.0069 mm.	13		
0.0049 mm.	11		
0.0034 mm.	11		
0.0025 mm.	11		
0.0014 mm.	11		

* (no specification provided)

Soil Description
 Silty sand with gravel

Atterberg Limits
 PL= 21 LL= 23 PI= 2

Coefficients
 D₉₀= 13.1559 D₈₅= 10.2575 D₆₀= 3.3902
 D₅₀= 1.7385 D₃₀= 0.2727 D₁₅= 0.0265
 D₁₀= C_u= C_c=

Classification
 USCS= SM AASHTO= A-1-b

Remarks
 SAMPLED BY: CLIENT
 SPECIFIC GRAVITY=2.59

Location: 5013-03-1/B-06 A 1.0'

Date: 12/14/21



**GEOTECHNICAL &
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SERVICES, INC.**

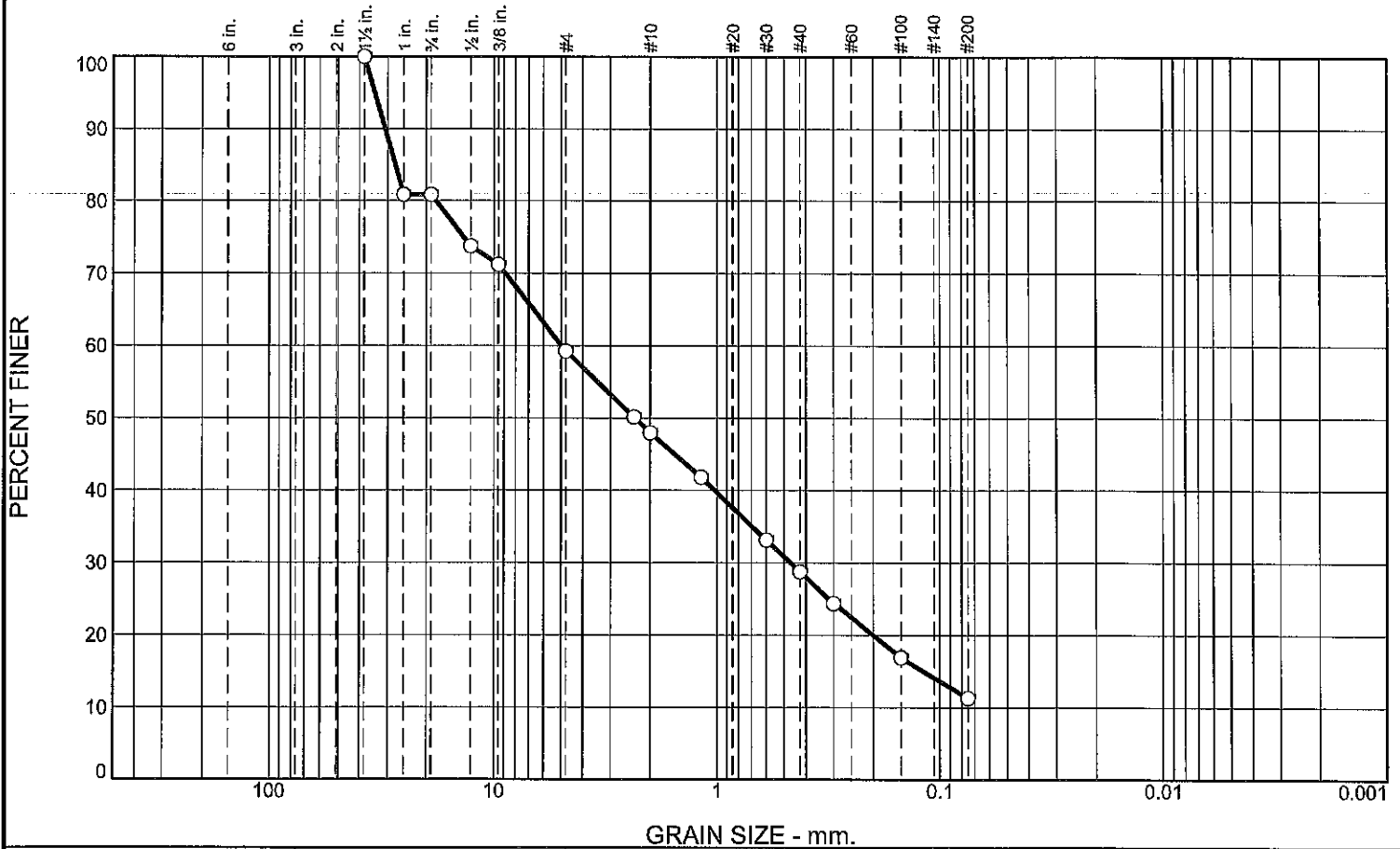
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	19	22	11	19	18	11	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	81		
.75	81		
.5	74		
.375	71		
#4	59		
#8	50		
#10	48		
#16	42		
#30	33		
#40	29		
#50	24		
#100	17		
#200	11		

<u>Soil Description</u>		
Poorly graded sand with silt and gravel		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D ₉₀ = 30.8141	D ₈₅ = 27.7116	D ₆₀ = 4.9592
D ₅₀ = 2.3389	D ₃₀ = 0.4686	D ₁₅ = 0.1188
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= SP-SM	AASHTO= A-1-a	
<u>Remarks</u>		
SAMPLED BY: CLIENT		

* (no specification provided)

Location: 5013-03-1/B-06 B 3.5'

Date: 12/14/21



GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

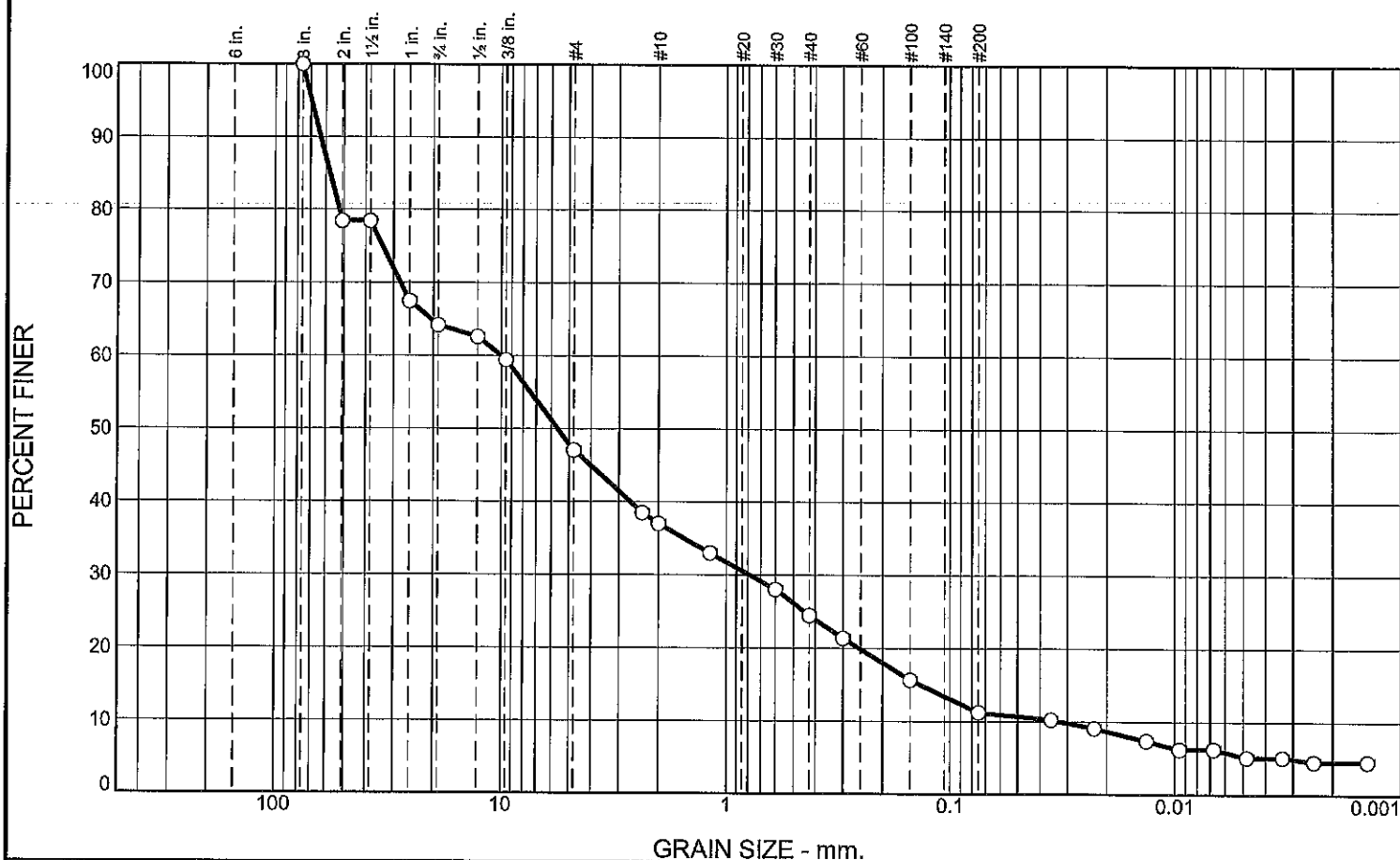
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	36	17	10	13	13	6	5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100		
2	78		
1.5	78		
1	67		
.75	64		
.5	63		
.375	59		
#4	47		
#8	38		
#10	37		
#16	33		
#30	28		
#40	24		
#50	21		
#100	16		
#200	11		
0.0356 mm.	10		
0.0228 mm.	9.1		
0.0134 mm.	7.4		
0.0096 mm.	6.2		
0.0068 mm.	6.2		
0.0048 mm.	5.1		
0.0034 mm.	5.1		
0.0024 mm.	4.5		
0.0014 mm.	4.5		

* (no specification provided)

Location: 5013-03-1/B-07 A 1.0'

<u>Soil Description</u>		
Poorly graded gravel with silt and sand		
<u>Atterberg Limits</u>		
PL= 23	LL= 25	PI= 2
<u>Coefficients</u>		
D ₉₀ = 63.1408	D ₈₅ = 57.4762	D ₆₀ = 10.0400
D ₅₀ = 5.6099	D ₃₀ = 0.7857	D ₁₅ = 0.1353
D ₁₀ = 0.0325	C _u = 308.47	C _c = 1.89
<u>Classification</u>		
USCS= GW-GM	AASHTO= A-1-a	
<u>Remarks</u>		
SAMPLED BY: CLIENT		
SPECIFIC GRAVITY=2.62		

Date: 12/14/21



GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

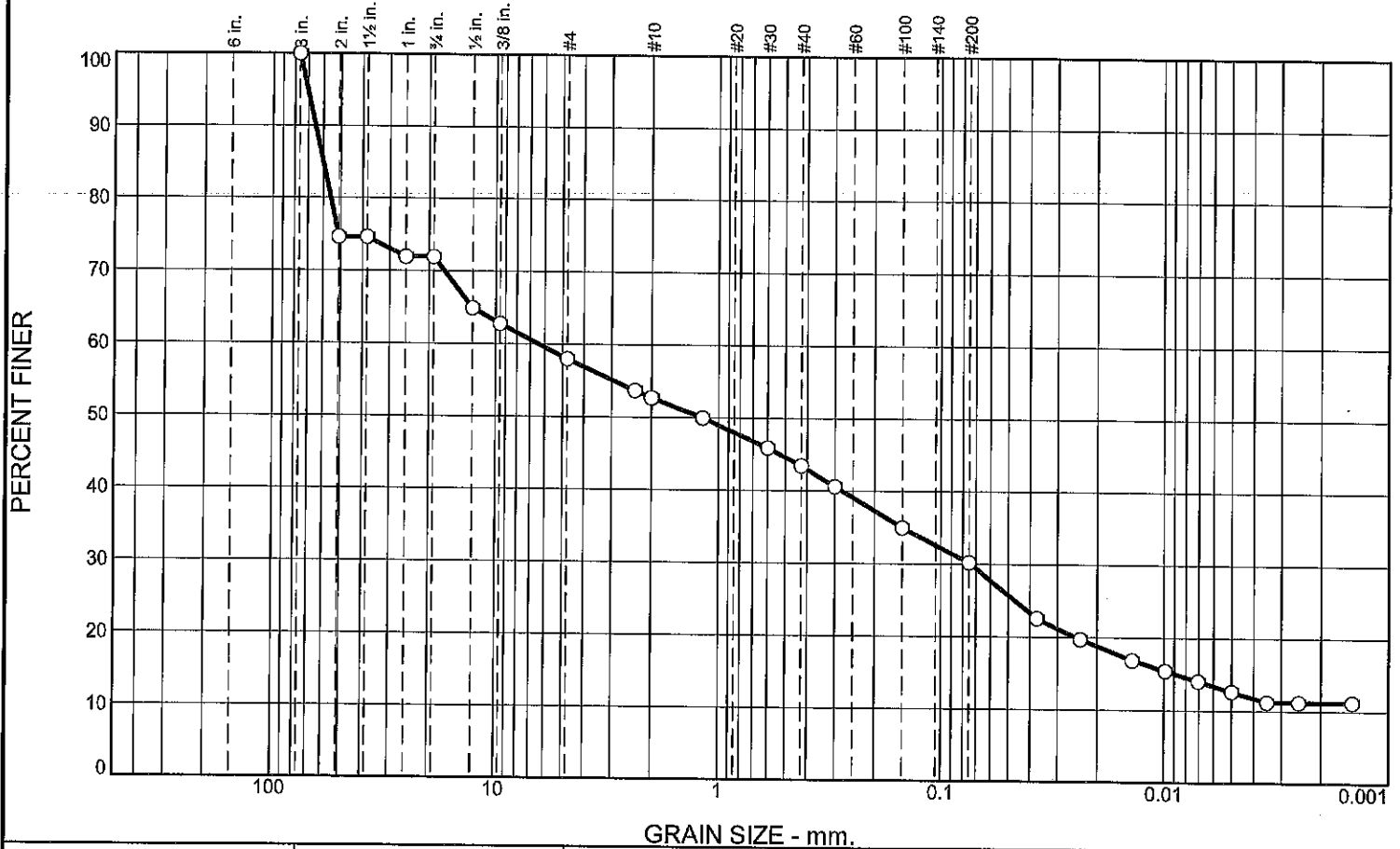
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	28	14	5	10	13	17	13

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100		
2	75		
1.5	75		
1	72		
.75	72		
.5	65		
.375	63		
#4	58		
#8	54		
#10	53		
#16	50		
#30	46		
#40	43		
#50	41		
#100	35		
#200	30		
0.0372 mm.	23		
0.0238 mm.	20		
0.0139 mm.	17		
0.0099 mm.	15		
0.0070 mm.	14		
0.0050 mm.	13		
0.0035 mm.	11		
0.0025 mm.	11		
0.0015 mm.	11		

* (no specification provided)

Soil Description		
Clayey gravel with sand		
Atterberg Limits		
PL= 18	LL= 31	PI= 13
Coefficients		
D ₉₀ = 64.9488	D ₈₅ = 59.9624	D ₆₀ = 6.3931
D ₅₀ = 1.1913	D ₃₀ = 0.0737	D ₁₅ = 0.0089
D ₁₀ =	C _u =	C _c =
Classification		
USCS= GC	AASHTO= A-2-6(0)	
Remarks		
Sampled by: client		

Location: 5013-03-1/B-08 A 1.0'

Date: 12/15/21



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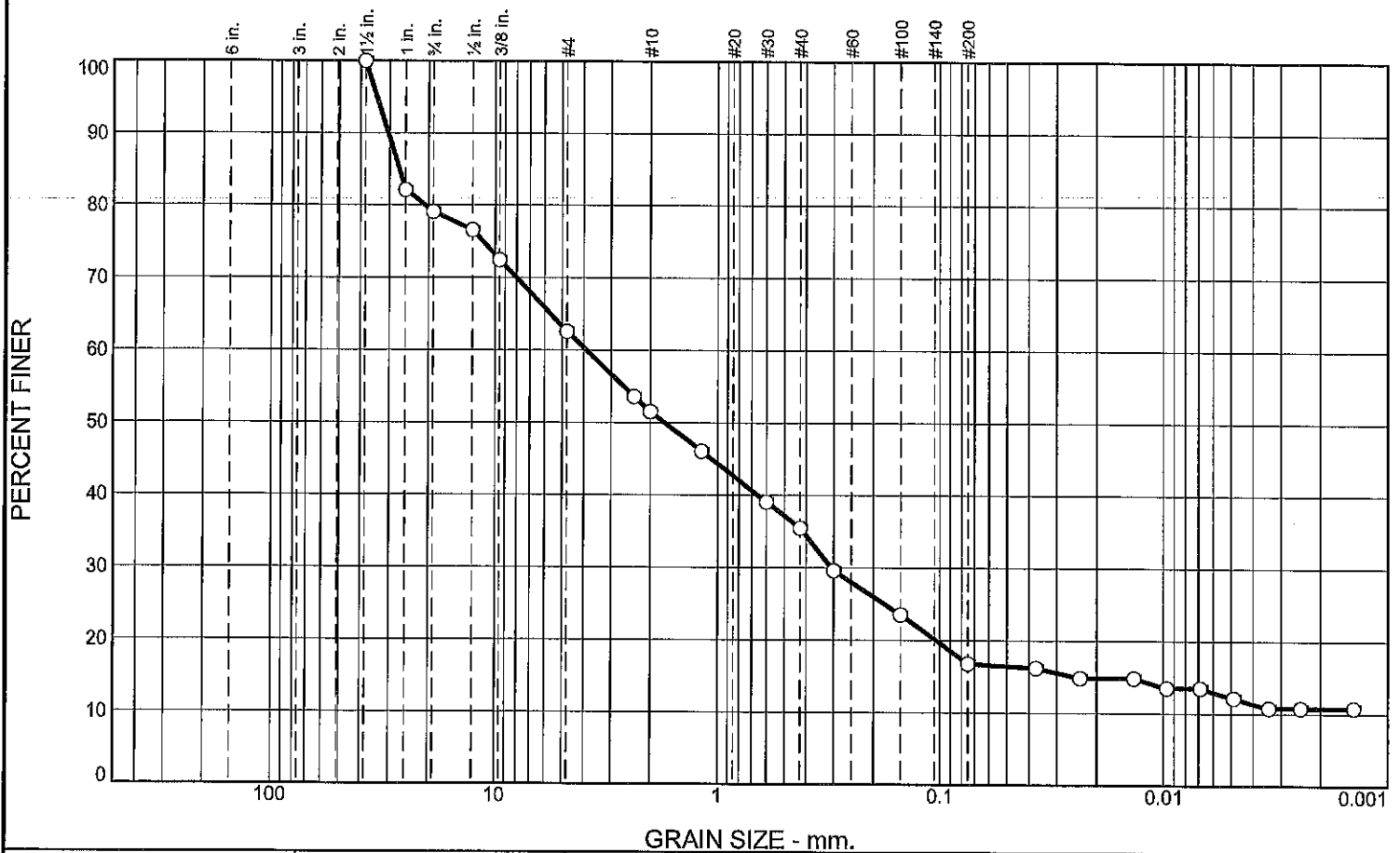
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: J. Roybal/A. Sanders

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	21	16	12	16	18	5	12

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	82		
.75	79		
.5	77		
.375	72		
#4	63		
#8	54		
#10	51		
#16	46		
#30	39		
#40	35		
#50	30		
#100	24		
#200	17		
0.0372 mm.	16		
0.0237 mm.	15		
0.0137 mm.	15		
0.0097 mm.	13		
0.0069 mm.	13		
0.0049 mm.	12		
0.0034 mm.	11		
0.0025 mm.	11		
0.0014 mm.	11		

* (no specification provided)

Location: 5013-03-1/B-09 A 1.0'

Soil Description

Silty sand with gravel

Atterberg Limits

PL= NP

LL= NV

PI= NP

Coefficients

D₉₀= 30.3625

D₈₅= 27.1046

D₆₀= 3.8880

D₅₀= 1.7293

D₃₀= 0.3075

D₁₅= 0.0249

D₁₀=

C_u=

C_c=

Classification

USCS= SM

AASHTO= A-1-b

Remarks

SAMPLED BY: CLIENT

SPECIFIC GRAVITY=2.59

Date: 10/14/21



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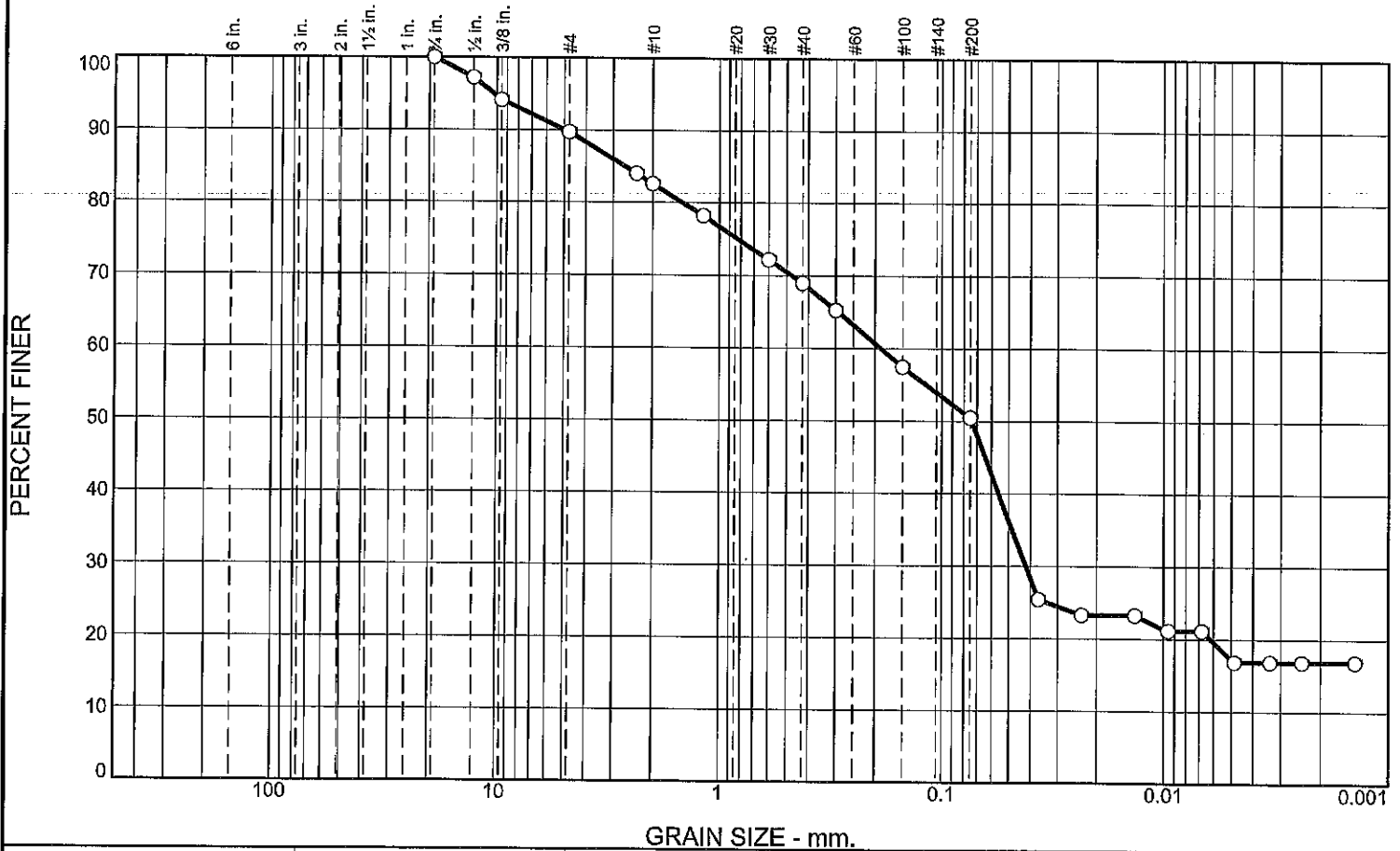
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	10	7	14	19	33	17

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100		
.5	97		
.375	94		
#4	90		
#8	84		
#10	83		
#16	78		
#30	72		
#40	69		
#50	65		
#100	57		
#200	50		
0.0368 mm.	25		
0.0234 mm.	23		
0.0135 mm.	23		
0.0096 mm.	21		
0.0068 mm.	21		
0.0049 mm.	17		
0.0034 mm.	17		
0.0024 mm.	17		
0.0014 mm.	17		

* (no specification provided)

<u>Soil Description</u>		
Sandy lean clay		
<u>Atterberg Limits</u>		
PL= 20	LL= 34	PI= 14
<u>Coefficients</u>		
D ₉₀ = 4.9689	D ₈₅ = 2.6655	D ₆₀ = 0.1882
D ₅₀ = 0.0740	D ₃₀ = 0.0419	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= CL	AASHTO= A-6(4)	
<u>Remarks</u>		
SAMPLED BY: CLIENT		
SPECIFIC GRAVITY=2.63		

Location: 5013-03-1/B-10 A 1.0

Date:



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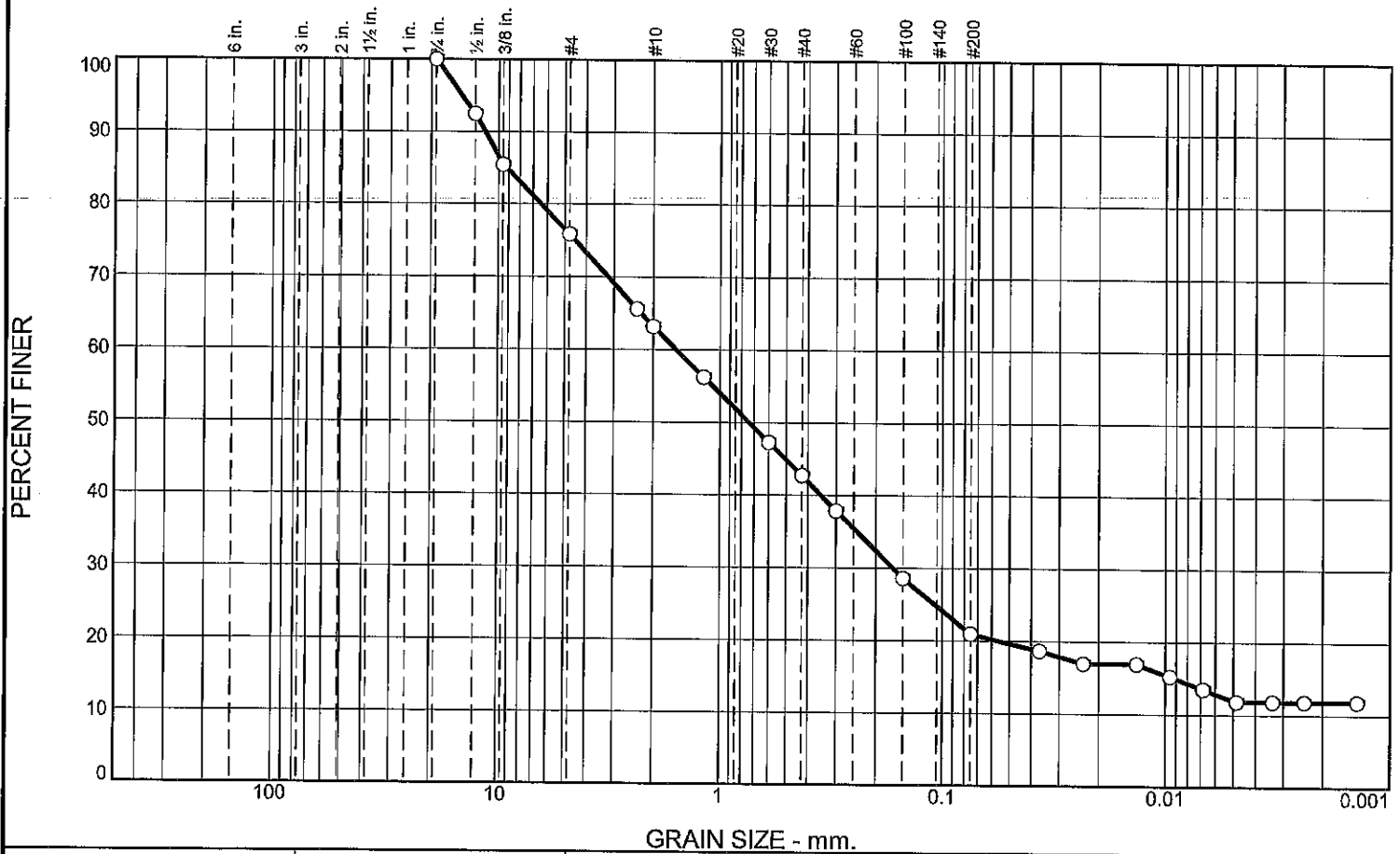
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	24	13	20	22	9	12

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100		
.5	92		
.375	85		
#4	76		
#8	66		
#10	63		
#16	56		
#30	47		
#40	43		
#50	38		
#100	29		
#200	21		
0.036 mm.	19		
0.023 mm.	17		
0.013 mm.	17		
0.009 mm.	15		
0.006 mm.	14		
0.004 mm.	12		
0.003 mm.	12		
0.002 mm.	12		
0.001 mm.	12		

* (no specification provided)

Soil Description
Silty sand with gravel

Atterberg Limits
 PL= 28 LL= 30 PI= 2

Coefficients
 D₉₀= 11.4737 D₈₅= 9.2198 D₆₀= 1.5696
 D₅₀= 0.7376 D₃₀= 0.1667 D₁₅= 0.0092
 D₁₀= C_u= C_c=

Classification
 USCS= SM AASHTO= A-1-b

Remarks
 SAMPLED BY: CLIENT
 SPECIFIC GRAVITY=2.65

Location: 5013-03-1/B-11 A 1.0'

Date:



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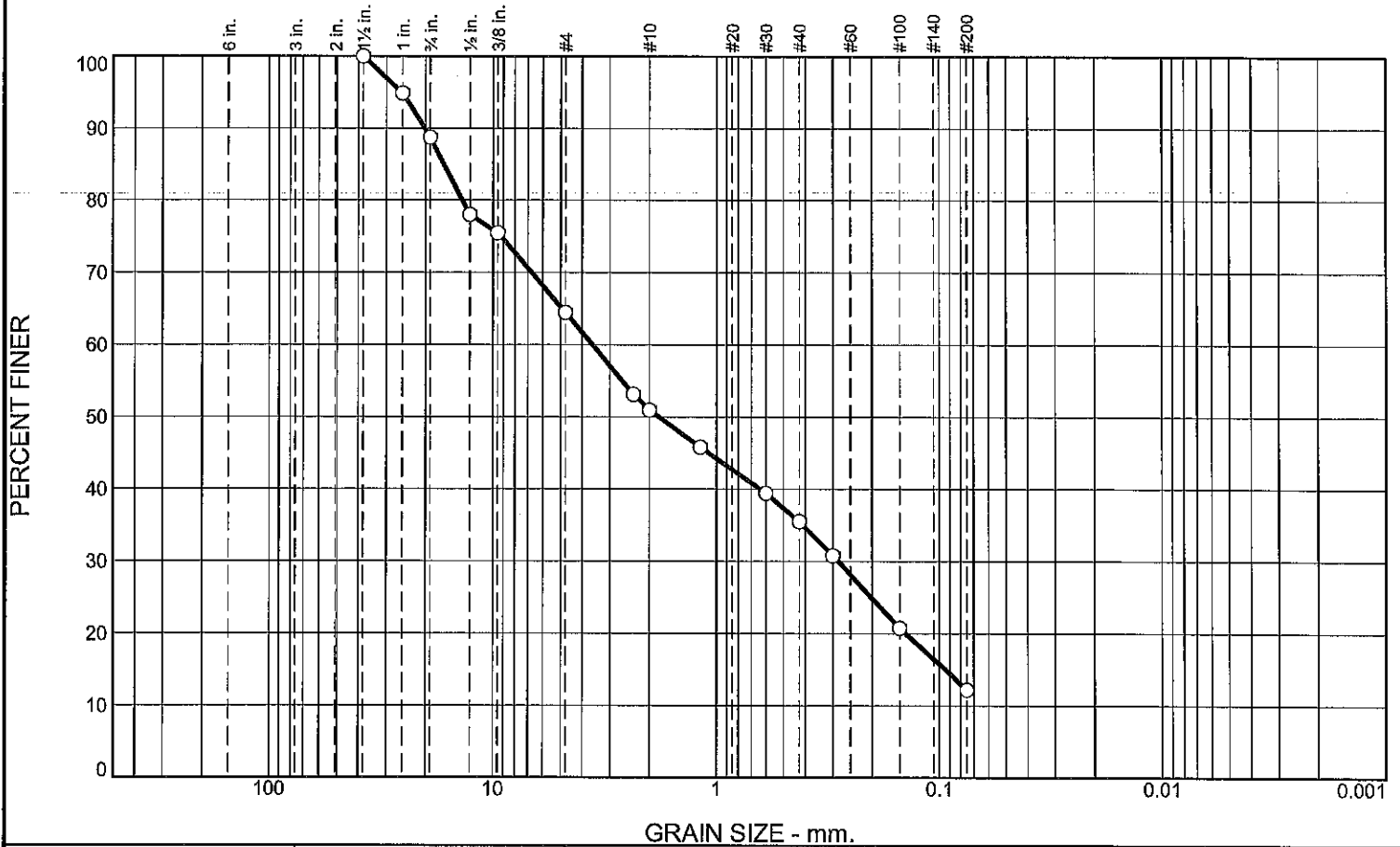
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A. SANDERS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	11	25	13	15	24	12	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	95		
.75	89		
.5	78		
.375	76		
#4	64		
#8	53		
#10	51		
#16	46		
#30	39		
#40	36		
#50	31		
#100	21		
#200	12		

<u>Soil Description</u>		
Poorly graded sand with silt and gravel		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D ₉₀ = 20.2243	D ₈₅ = 16.5455	D ₆₀ = 3.6043
D ₅₀ = 1.8164	D ₃₀ = 0.2840	D ₁₅ = 0.0943
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= SP-SM	AASHTO= A-1-b	
<u>Remarks</u>		
Sampled by: Client		

* (no specification provided)

Location: 5013-03-1/B-12 A 1.0'

Date: 12/15/21



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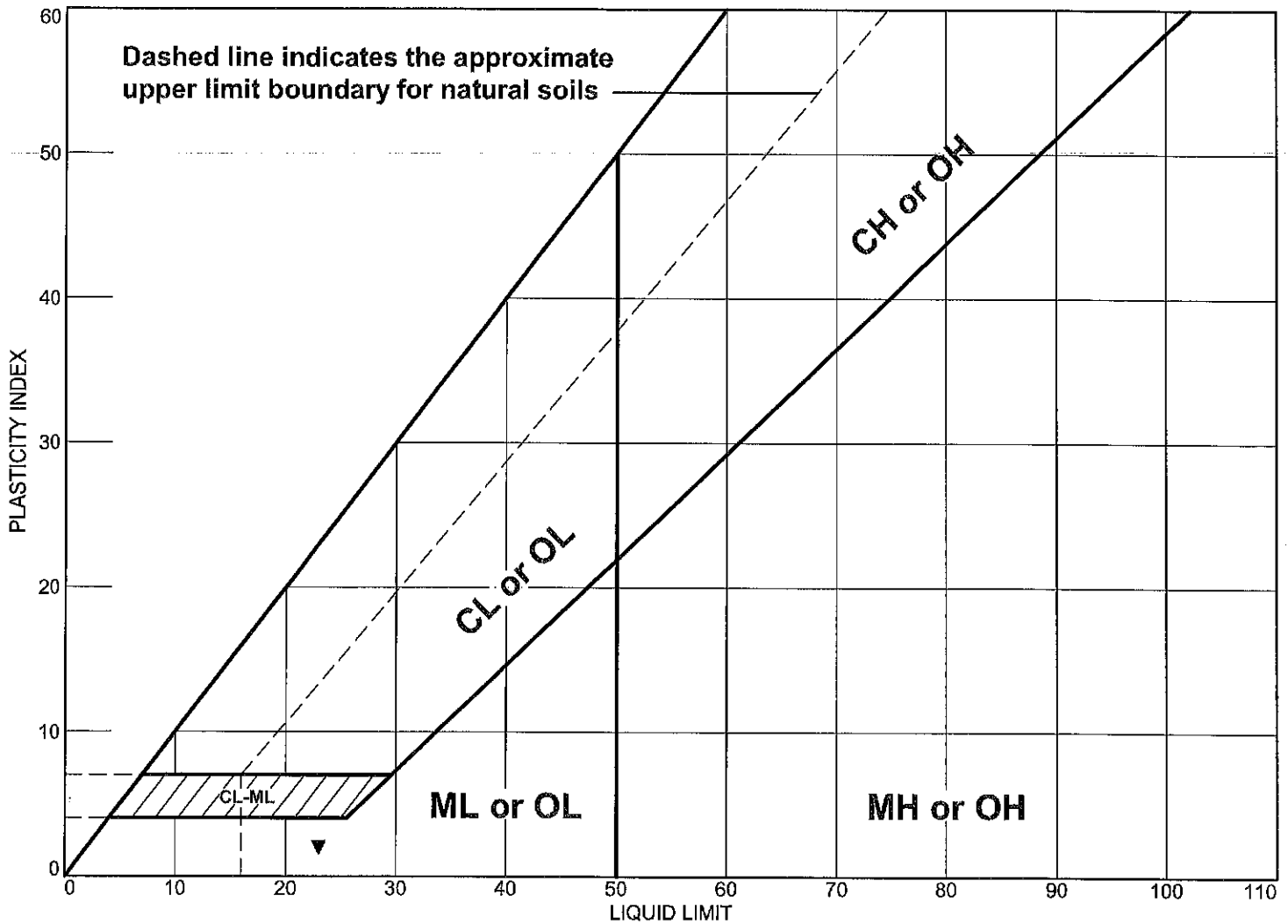
Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

Project No: R20215509C1

Figure

Tested By: A.Sanders

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	poorly graded sand with silt and gravel	NV	NP	NP	38	19	GM
■	silty sand with gravel	NV	NP	NP	31	13	SM
▲	silty sand with gravel	NV	NP	NP	51	25	SM
◆	Silty sand with gravel	23	23	NP	39	21	SM
▼	Silty sand with gravel	23	21	2	35	18	SM

Project No. R20215509C1 **Client:** Corestone Engineering

Project: WEED AIRPORT PROJECT

● **Location:** 5013-03-1/B-03 A 1.0'

■ **Location:** 5013-03-1/B-04 A 1.0'

▲ **Location:** 5013-03-1/B-04 B 3.5'

◆ **Location:** 5013-03-1/B-05 A 1.0'

▼ **Location:** 5013-03-1/B-06 A 1.0'

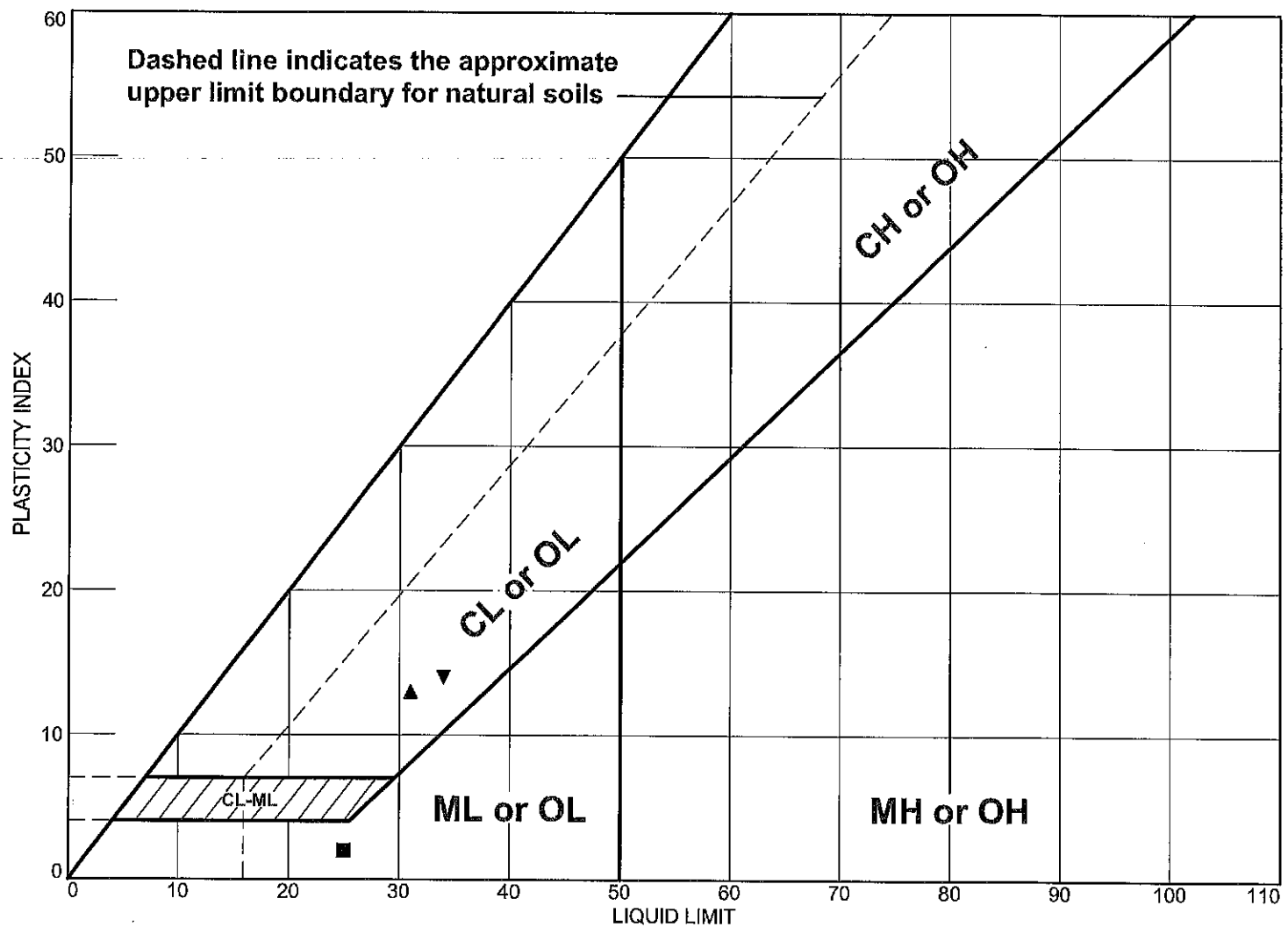


Remarks:

Figure

Tested By: A. Sanders

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Poorly graded sand with silt and gravel	NV	NP	NP	29	11	SP-SM
■	Poorly graded gravel with silt and sand	25	23	2	24	11	GW-GM
▲	Clayey gravel with sand	31	18	13	43	30	GC
◆	Silty sand with gravel	NV	NP	NP	35	17	SM
▼	Sandy lean clay	34	20	14	69	50	CL

Project No. R20215509C1 Client: Corestone Engineering
Project: WEED AIRPORT PROJECT

- Location: 5013-03-1/B-06 B 3.5'
- Location: 5013-03-1/B-07 A 1.0'
- ▲ Location: 5013-03-1/B-08 A 1.0'
- ◆ Location: 5013-03-1/B-09 A 1.0'
- ▼ Location: 5013-03-1/B-10 A 1.0'

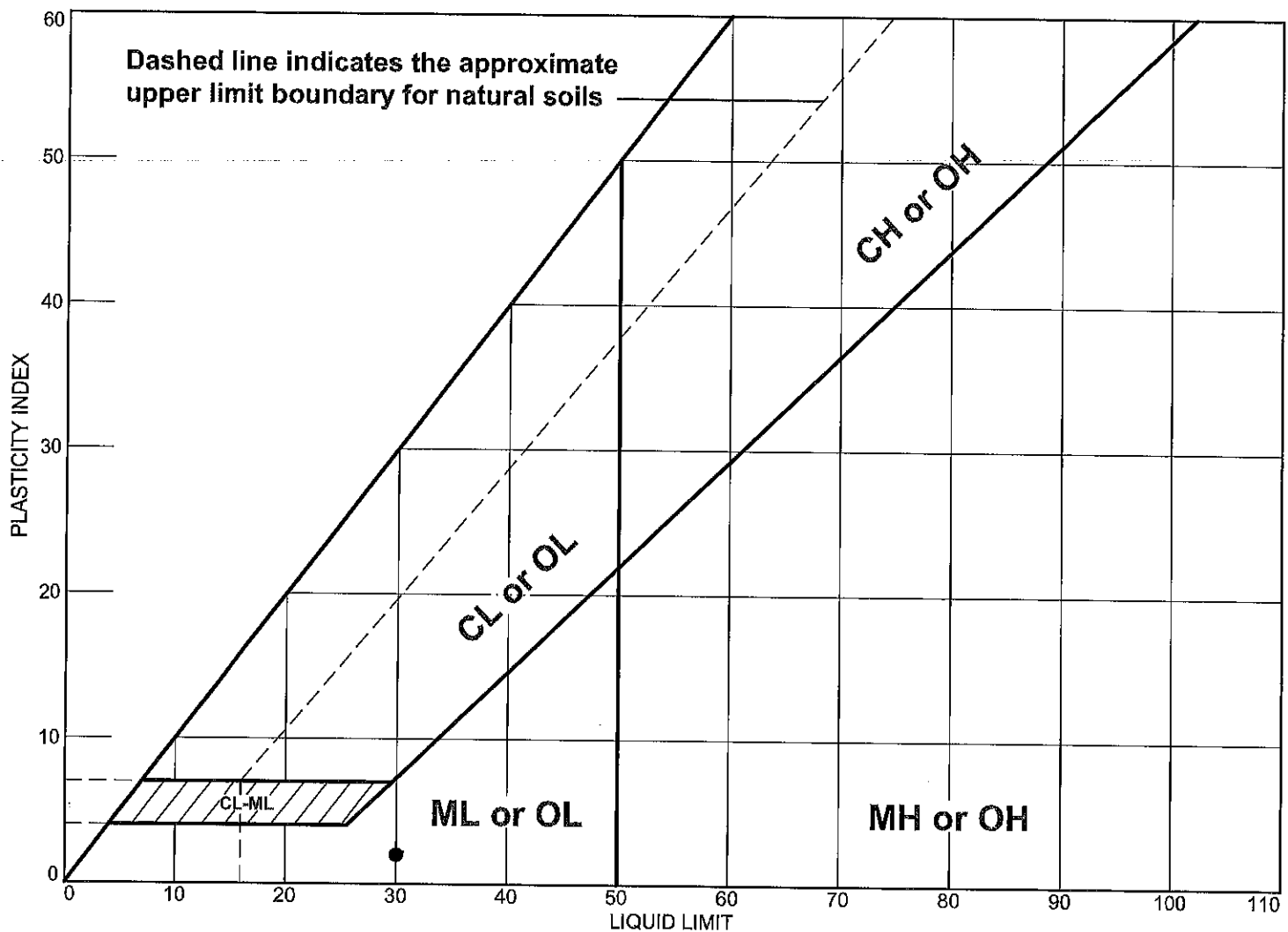


Remarks:

Figure

Tested By: ● A. Sanders ■ A. Sanders ▲ A. Sanders ◆ A. SANDERS ▼ A. SANDERS

LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION		LL	PL	PI	%<#40	%<#200	USCS
●	Silty sand with gravel	30	28	2	43	21	SM
■	Poorly graded sand with silt and gravel	NV	NP	NP	36	12	SP-SM

Project No. R20215509C1 Client: Corestone Engineering

Project: WEED AIRPORT PROJECT

● Location: 5013-03-1/B-11 A 1.0'

■ Location: 5013-03-1/B-12 A 1.0'

Remarks:



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Figure

Tested By: A. SANDERS



**GEOTECHNICAL &
ENVIRONMENTAL
SERVICES, INC.**

7150 Placid Street
Las Vegas, NV 89119
(702) 365-1001

Moisture/Density Log - Sample Rings

Project Name: WEED AIRPORT PROJECT					Lab No.: 21-148			
Project No.: R20215509C1			Tested By: A. Sanders			Date: 10/14/21		
Sample	B-01	B-02	B-03	B-05	B-06	B-07	B-08	B-09
Depth	A 1.0'	A 1.0'	A 1.0'	A 1.0'	A 1.0'	A 1.0'	A 1.0'	A 1.0'
Soil Description: Remarks/Condition:								
Length (in)	5.5	6	6	6	6	6	5	5
Tube + Wet Soil (gm)	1020.00	1073.00	1114.20	1098.70	1077.92	1130.72	1010.84	1011.25
Tube (gm)	231.00	252.00	252.00	252.00	252.00	252.00	210.00	210.00
Wet Soil (gm)	789.00	821.00	862.20	846.70	825.92	878.72	800.84	801.25
Volume (ft³)	0.0144	0.0157	0.0157	0.0157	0.0157	0.0157	0.0131	0.0131
Wet Density lbs/ft³	120.8	115.2	121.0	118.8	115.9	123.3	134.9	134.9
Tare + Wet Soil (gm)	481.20	316.20	696.30	557.03	511.48	429.81	565.43	948.55
Tare + Dry Soil (gm)	461.70	304.90	691.60	499.07	485.76	403.92	503.82	866.10
Water Loss (gm)	19.50	11.30	4.70	57.96	25.72	25.89	61.61	82.45
Tare Weight (gm)	153.00	153.30	152.60	150.58	153.05	154.08	151.07	152.36
Wt. Dry Soil (gm)	308.70	151.60	539.00	348.49	332.71	249.84	352.75	713.74
Moisture Content (%)	6.3	7.5	0.9	16.6	7.7	10.4	17.5	11.6
Dry Density (lbs/ft³)	113.6	107.2	120.0	101.9	107.6	111.7	114.8	121.0



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SERVICES, INC.**

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Las Vegas, NV 89119
(702) 365-1001

Moisture/Density Log - Sample Rings

Project Name: WEED AIRPORT PROJECT				Lab No.: 21-148			
Project No.: R20215509C1		Tested By: A. Sanders		Date: 10/14/21			
Sample	B-10	B-11					
Depth	A 1.0'	A 4.0'					
Soil Description: Remarks/Condition:							
Length (in)	5	6					
Tube + Wet Soil (gm)	1061.10	1074.06					
Tube (gm)	210.00	252.00					
Wet Soil (gm)	851.10	822.06					
Volume (ft³)	0.0131	0.0157					
Wet Density lbs/ft³	143.3	115.4					
Tare + Wet Soil (gm)							
	542.73	340.24					
Tare + Dry Soil (gm)							
	478.40	317.10					
Water Loss (gm)							
	64.33	23.14					
Tare Weight (gm)							
	152.96	153.38					
Wt. Dry Soil (gm)							
	325.44	163.72					
Moisture Content (%)							
	19.8	14.1					
Dry Density (lbs/ft³)							
	119.7	101.1					



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SERVICES, INC.**

7150 Placid Street
Las Vegas, NV 89119
(702) 365-1001

Moisture Content Log

Project Name: WEED AIRPORT PROJECT

Lab No.: 21-148

Project No.: R20215509C1

Tested By: A. Sanders

Date: 10/14/2021

	Sample:	B-01	B-02	B-03	B-04	B-04	B-05
	Depth:	A 1.0'	A 1.0'	A 1.0'	A 1.0'	B 3.5'	A 1.0'
WET WT. + TARE		481.20	316.20	696.30	526.50	636.60	760.33
DRY WT. + TARE		461.70	304.90	691.60	494.30	589.50	723.37
TARE WT.		153.00	153.30	152.60	155.00	155.00	151.02
DRY WT.		308.70	151.60	539.00	339.30	434.50	572.35
WEIGHT LOST		19.50	11.30	4.70	32.20	47.10	36.96
% MOISTURE		6.3	7.5	0.9	9.5	10.8	6.5

Remarks/Condition: _____



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SERVICES, INC.**

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Moisture Content Log

Project Name: WEED AIRPORT PROJECT

Lab No.: 21-148

Project No.: R20215509C1

Tested By: A. Sanders

Date: 10/14/2021

	Sample:	B-06	B-06	B-07	B-08	B-09	B-10
	Depth:	A 1.0'	B 3.5'	A 1.0'	A 1.0'	A 1.0'	A 1.0'
WET WT. + TARE		537.83	1143.40	433.47	565.43	948.55	542.73
DRY WT. + TARE		512.43	1101.20	410.97	503.82	866.10	478.40
TARE WT.		152.69	379.80	153.62	151.07	152.36	152.96
DRY WT.		359.74	721.40	257.35	352.75	713.74	325.44
WEIGHT LOST		25.40	42.20	22.50	61.61	82.45	64.33
% MOISTURE		7.1	5.8	8.7	17.5	11.6	19.8

Remarks/Condition: _____



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Moisture Content Log

Project Name: WEED AIRPORT PROJECT

Lab No.: 21-148

Project No.: R20215509C1

Tested By: A. Sanders

Date: 10/14/2021

Sample:	B-11	B-12	B-01&B-02	B-05&B-10	B-08&B-09	
Depth:	A 1.0'	A 1.0'				
WET WT. + TARE	340.24	1065.00	434.40	403.80	414.30	
DRY WT. + TARE	317.10	993.60	397.40	385.40	374.00	
TARE WT.	153.38	380.21	126.50	134.80	127.40	
DRY WT.	163.72	613.39	270.90	250.60	246.60	
WEIGHT LOST	23.14	71.40	37.00	18.40	40.30	
% MOISTURE	14.1	11.6	13.7	7.3	16.3	

Remarks/Condition: _____

APPENDIX B

MOISTURE-DENSITY RELATIONSHIP TEST RESULTS

COMPACTION TEST REPORT

Project No.: R20215509C1

Date: 12/14/21

Project: WEED AIRPORT PROJECT

Client: Corestone Engineering

Location: 5013-03-1/B-1 THRU B-2 BULK

Remarks:

MATERIAL DESCRIPTION

Description: Silty sand with gravel

Classifications -

USCS: SM

AASHTO: A-1-b

Nat. Moist. =

Sp.G. = 2.110

Liquid Limit = NV

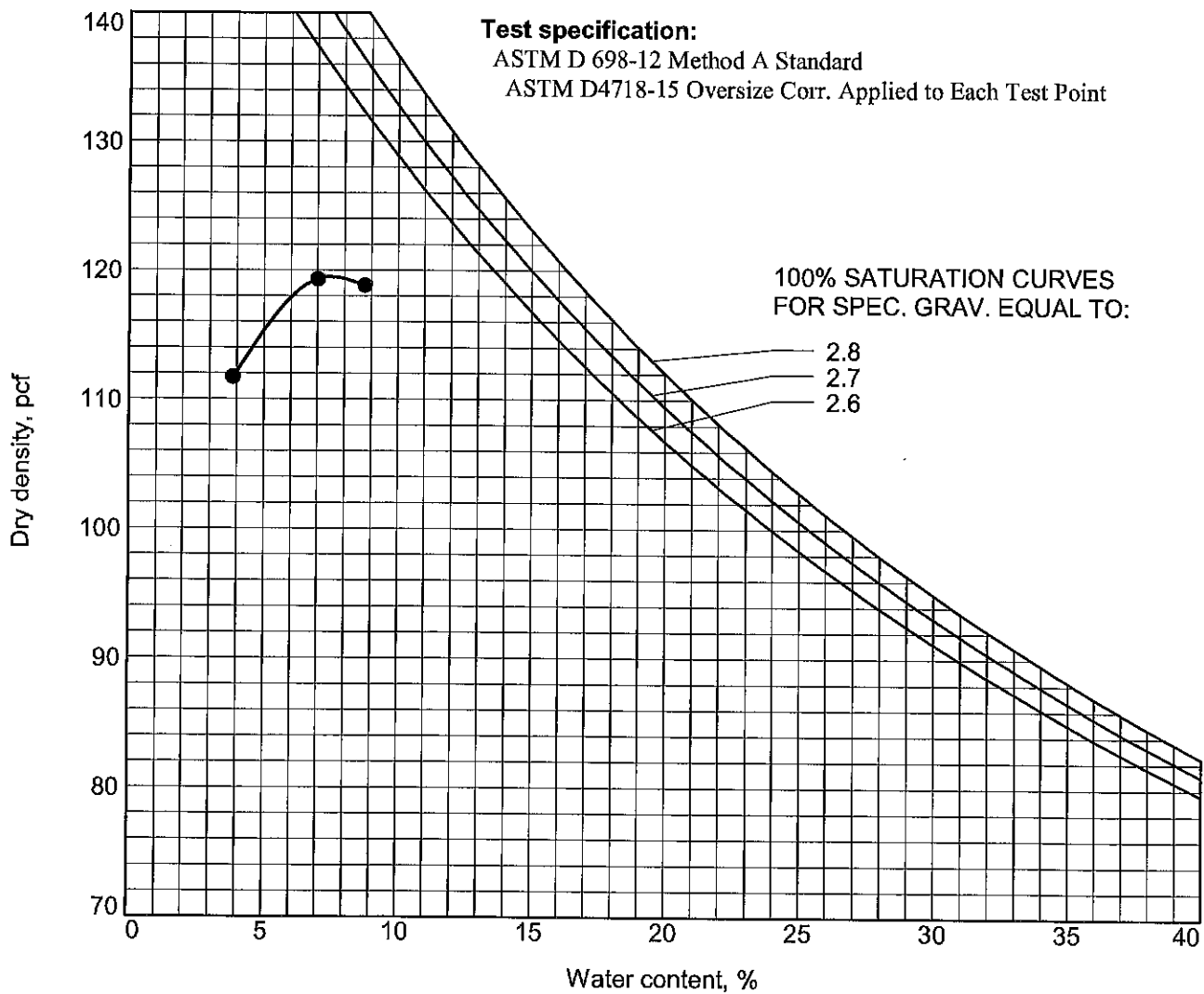
Plasticity Index = NP

% < No.200 = 23 %

ROCK CORRECTED TEST RESULTS

Maximum dry density = 119.5 pcf

Optimum moisture = 7.5 %



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Figure

Tested By: D. YOON

COMPACTION TEST REPORT

Project No.: R20215509C1

Date: 12/14/21

Project: WEED AIRPORT PROJECT

Client: Corestone Engineering

Location: 5013-03-1/B-5 AND B-10 BULK

Remarks:

MATERIAL DESCRIPTION

Description: Silty sand with gravel

Classifications -

USCS: SM

AASHTO: A-1-b

Nat. Moist. =

Sp.G. = 2.343

Liquid Limit = NV

Plasticity Index = NP

% < No.200 = 18 %

ROCK CORRECTED TEST RESULTS

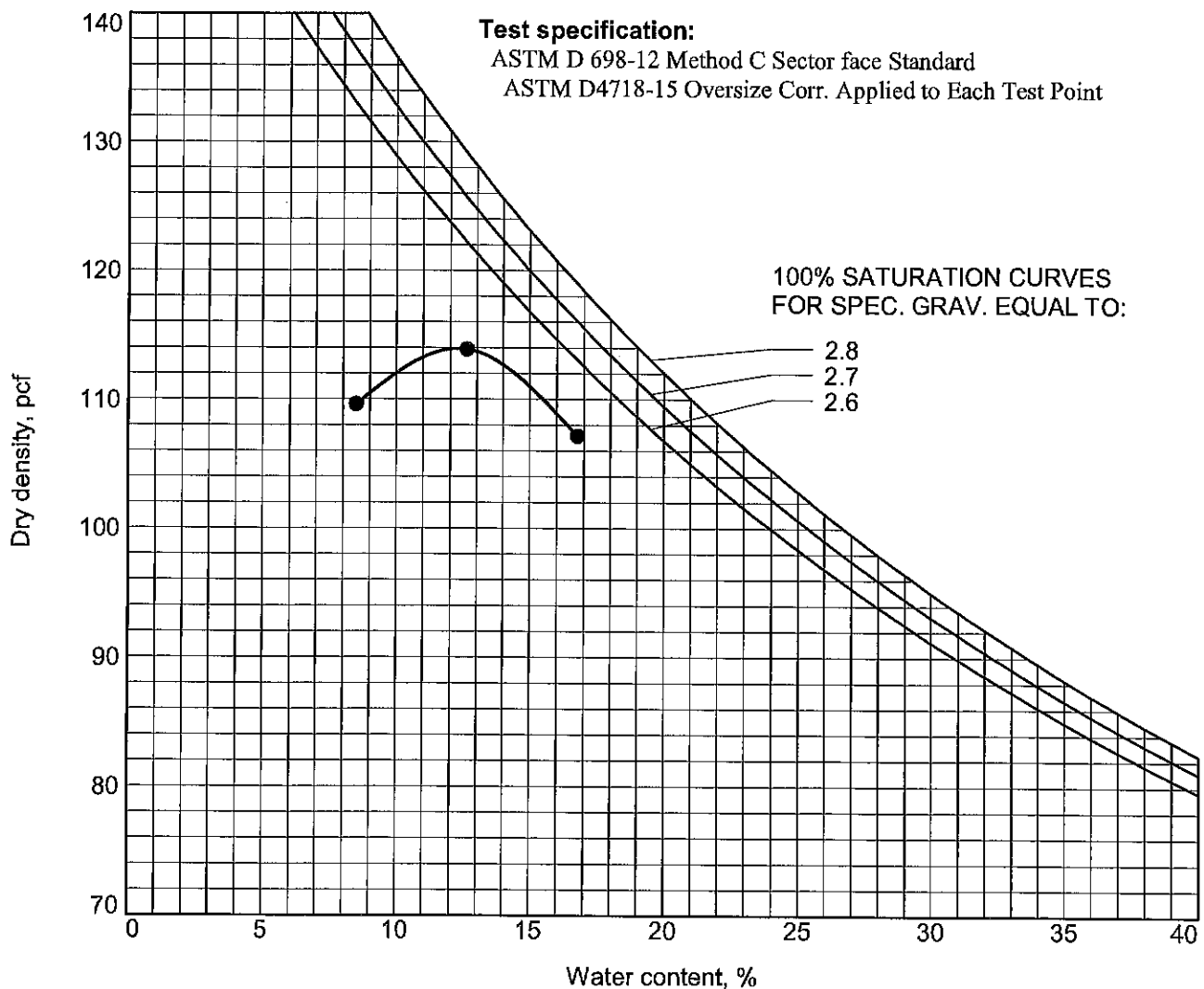
Maximum dry density = 113.9 pcf

Optimum moisture = 12.3 %

Test specification:

ASTM D 698-12 Method C Sector face Standard

ASTM D4718-15 Oversize Corr. Applied to Each Test Point



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Figure

Tested By: D. YOON

COMPACTION TEST REPORT

Project No.: R20215509C1

Date: 10/14/21

Project: WEED AIRPORT PROJECT

Client: Corestone Engineering

Location: 5013-03-1/B-8 THRU B-9 BULK

Remarks:

MATERIAL DESCRIPTION

Description: Silty sand with gravel

Classifications -

USCS: SM

AASHTO: A-1-b

Nat. Moist. =

Sp.G. = 2.343

Liquid Limit = NV

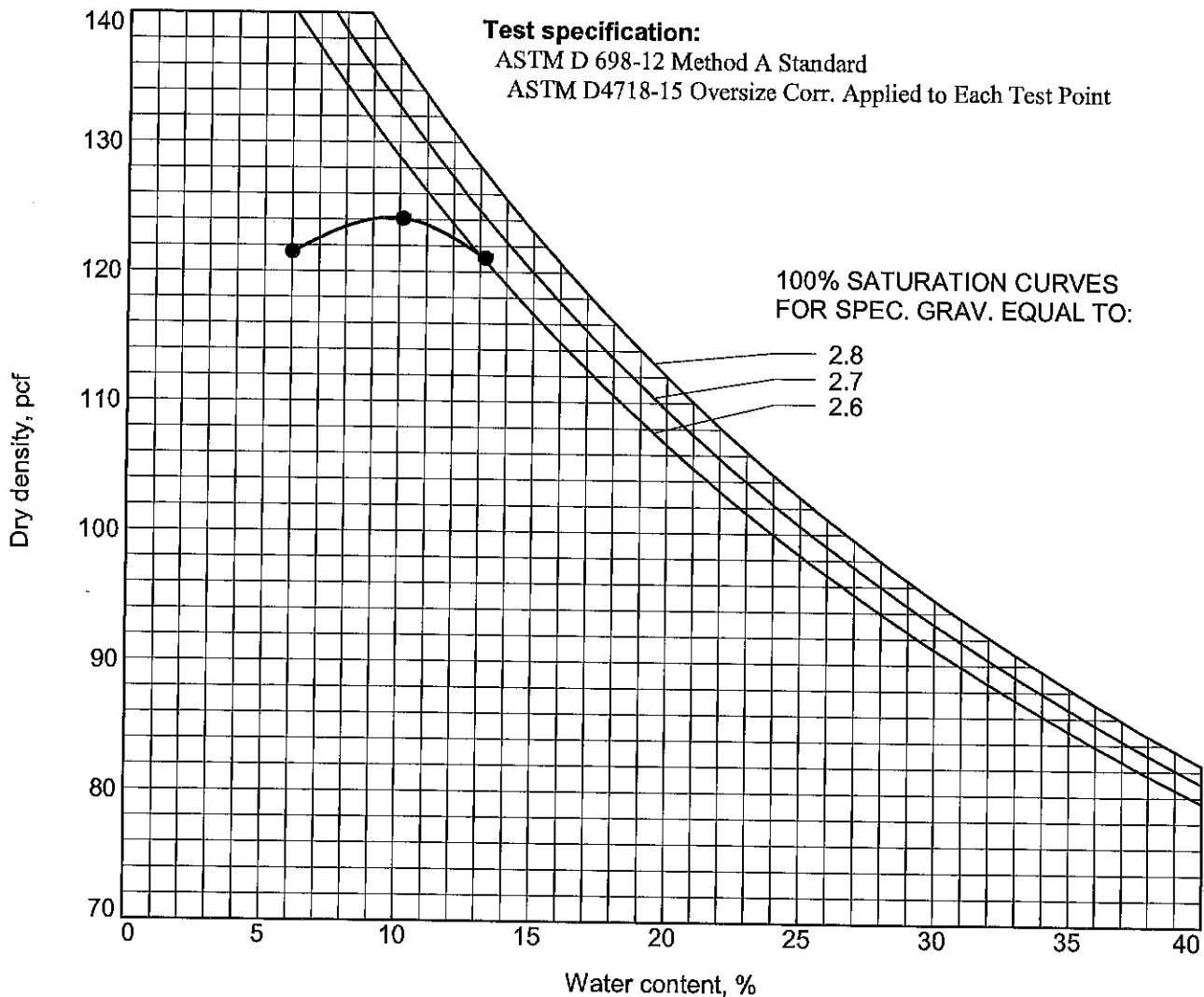
Plasticity Index = NP

% < No.200 = 17 %

ROCK CORRECTED TEST RESULTS

Maximum dry density = 124.2 pcf

Optimum moisture = 9.7 %



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Figure

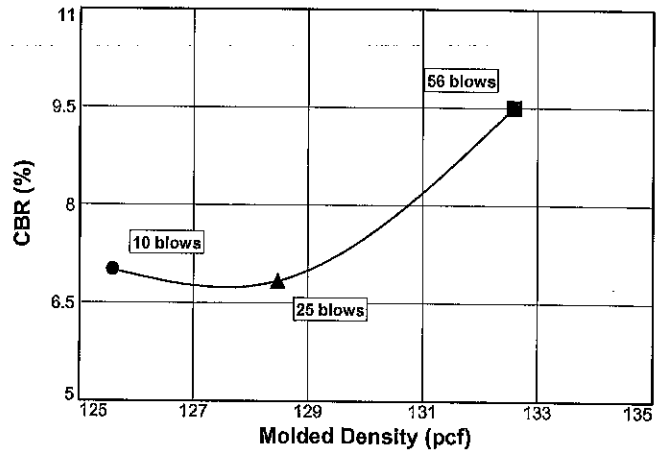
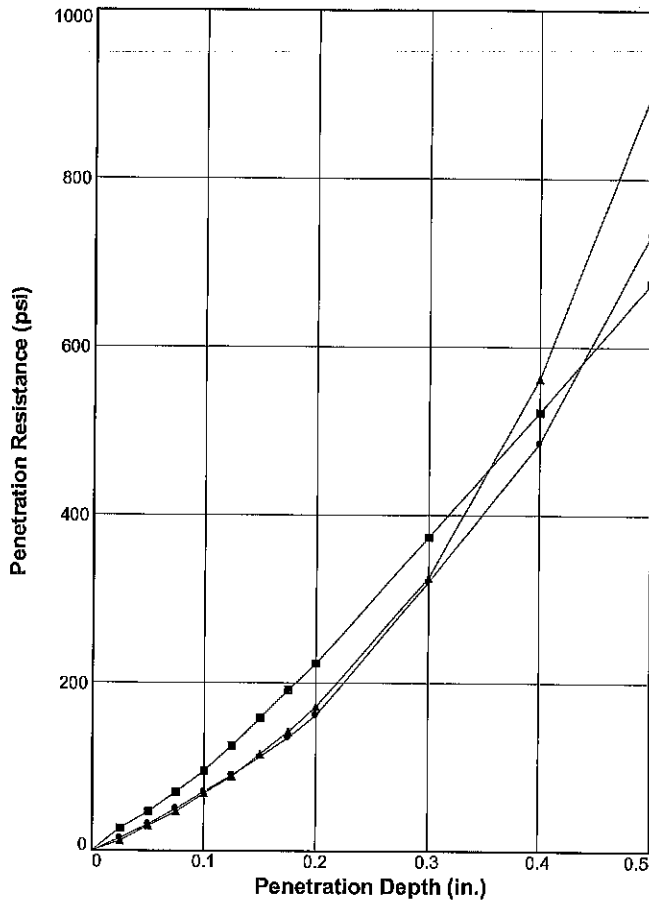
Tested By: D. YOON

APPENDIX C

CBR TEST RESULTS

BEARING RATIO TEST REPORT

ASTM D1883-05



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	125.6	110.3	14.5	125.5	110.2	14.5	7.0	10.8	0.000		0.1
2 △	128.5	112.8	13.0	128.5	112.8	13.0	6.8	11.4	0.000		0
3 □	132.6	116.4	12.0	130.3	114.4	12.0	9.5	14.9	0.000		1.8

Material Description							USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Silty sand with gravel							SM	113.9	12.3	NV	NP

Project No: R20215509C1
Project: WEED AIRPORT PROJECT
Location: 5013-03-1/B-5 AND B-10 BULK

Date: 12/14/21



Test Description/Remarks:

Figure _____

Tested By: C. Byer

BEARING RATIO TESTING RESULTS (ASTM D1883-05)

Date: 12/14/21
Project No.: R20215509C1
Project: WEED AIRPORT PROJECT
Location: 5013-03-1/B-5 AND B-10 BULK
Material Description: Silty sand with gravel
USCS Classification: SM
Liquid Limit: NV **Plasticity Index:** NP

Test Description:
Maximum Dry Density, pcf : 113.9 **Optimum Moisture Content, %:** 12.3
Testing Remarks:

Sample 1 (10 Blows)

Water Content

Wt. Wet Soil+Tare, gms. 581.5 Wt. Soil+Tare, gms. 525.5 Wt. Tare, gms. 139.4 **Moisture, % 14.5**

Unit Weight

Wt. Mold+Soil, gms. 8466.8 Wt. Mold, gms. 4197.0 Ht. Soil, in. 4 **Density, pcf 125.6**

Swell Data

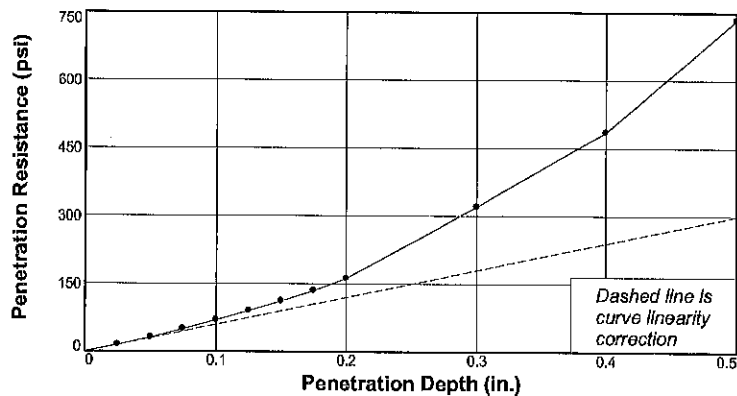
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	556	0.0
96	560	0.1

Final Water Content

	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	581.5	525.5	139.4	14.5

Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	45	15.0	
0.05	95	31.7	
0.075	150	50.0	
0.1	210	70.0	7.0
0.125	270	90.0	
0.15	335	111.7	
0.175	405	135.0	
0.2	485	161.7	10.8
0.3	960	320.0	16.8
0.4	1455	485.0	21.1
0.5	2200	733.3	28.2



Sample 2 (25 Blows)

Water Content

Wt. Wet Soil+Tare, gms. 548.0 Wt. Soil+Tare, gms. 501.8 Wt. Tare, gms. 145.5

Moisture, % 13.0

Unit Weight

Wt. Mold+Soil, gms. 8502.4 Wt. Mold, gms. 4194.0 Ht. Soil, in. 4

Density, pcf 128.5

Swell Data

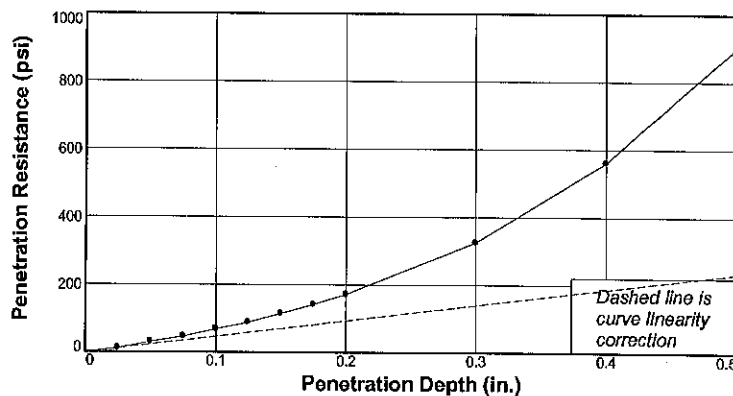
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	674	0.0
96	348	-8.2

Final Water Content

Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1) 548.0	501.8	145.5	13.0

Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	35	11.7	
0.05	90	30.0	
0.075	140	46.7	
0.1	205	68.3	6.8
0.125	265	88.3	
0.15	345	115.0	
0.175	425	141.7	
0.2	515	171.7	11.4
0.3	975	325.0	17.1
0.4	1685	561.7	24.4
0.5	2700	900.0	34.6



Sample 3 (56 Blows)

Water Content

Wt. Wet Soil+Tare, gms. 456.4 Wt. Soil+Tare, gms. 422.0 Wt. Tare, gms. 136.2

Moisture, % 12.0

Unit Weight

Wt. Mold+Soil, gms. 8599.3 Wt. Mold, gms. 4189.3 Ht. Soil, in. 4

Density, pcf 132.6

Swell Data

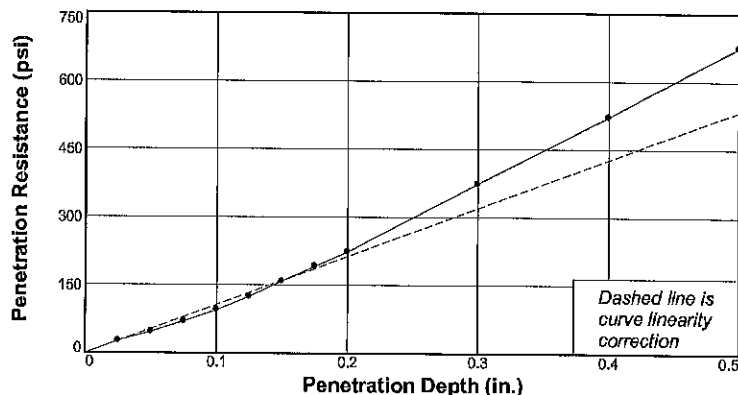
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	697	0.0
96	767	1.8

Final Water Content

Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1) 456.4	422.0	136.2	12.0

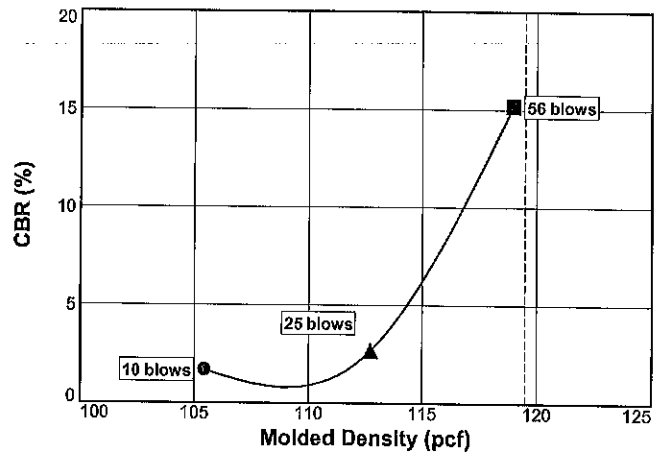
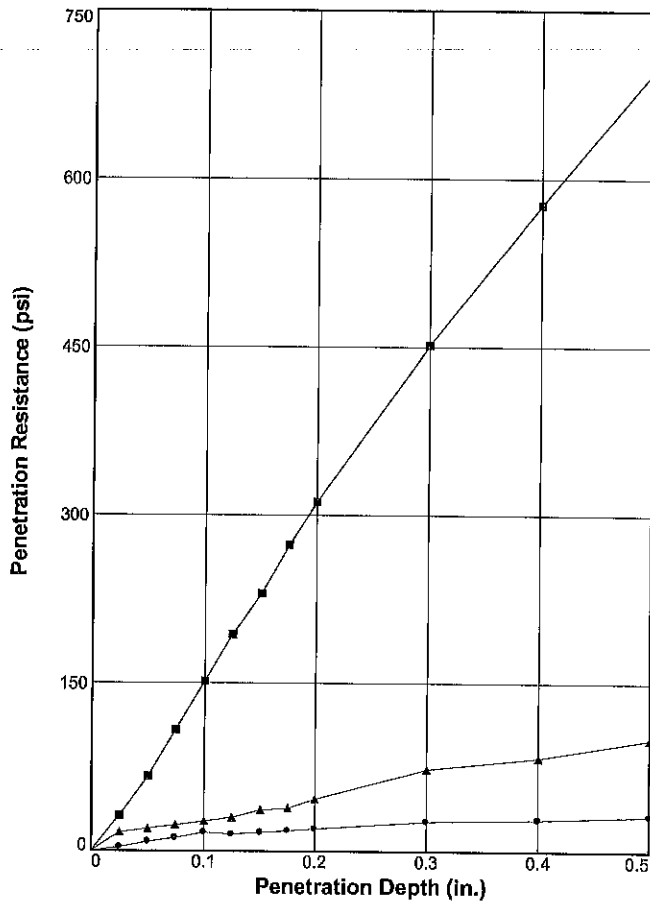
Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	80	26.7	
0.05	140	46.7	
0.075	210	70.0	
0.1	285	95.0	9.5
0.125	375	125.0	
0.15	475	158.3	
0.175	575	191.7	
0.2	670	223.3	14.9
0.3	1120	373.3	19.6
0.4	1565	521.7	22.7
0.5	2025	675.0	26.0



BEARING RATIO TEST REPORT

ASTM D1883-05



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	105.5	88.3	18.7	105.5	88.3	18.7	1.7	1.3	0.000		0
2 △	112.7	94.3	18.8	112.7	94.3	18.8	2.7	3.1	0.000		0
3 □	119.0	99.6	16.0	113.6	95.1	16.0	15.2	20.8	0.000		4.7
Material Description							USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Silty sand with gravel							SM	119.5	7.5	NV	NP

Project No: R20215509C1
Project: WEED AIRPORT PROJECT
Location: 5013-03-1/B-1 THRU B-2 BULK
Date: 12/14/21



Test Description/Remarks:

Figure _____

Tested By: C. Byer

BEARING RATIO TESTING RESULTS (ASTM D1883-05)

Date: 12/14/21
Project No.: R20215509C1
Project: WEED AIRPORT PROJECT
Location: 5013-03-1/B-1 THRU B-2 BULK
Material Description: Silty sand with gravel
USCS Classification: SM
Liquid Limit: NV **Plasticity Index:** NP

Test Description:
Maximum Dry Density, pcf : 119.5 **Optimum Moisture Content, %:** 7.5
Testing Remarks:

Sample 1 (10 Blows)

Water Content

Wt. Wet Soil+Tare, gms. 455.8 Wt. Soil+Tare, gms. 404.1 Wt. Tare, gms. 127.1 **Moisture, % 18.7**

Unit Weight

Wt. Mold+Soil, gms. 7907.8 Wt. Mold, gms. 4192.4 Ht. Soil, in. 4 **Density, pcf 105.5**

Swell Data

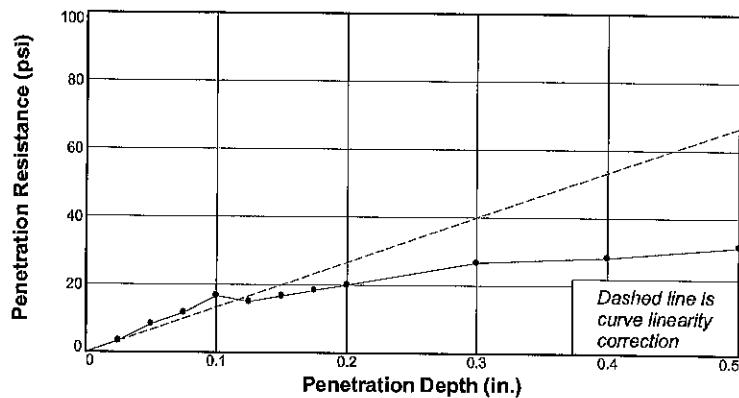
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	485	0.0
96	412	-1.8

Final Water Content

	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	455.8	404.1	127.1	18.7

Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	10	3.3	
0.05	25	8.3	
0.075	35	11.7	
0.1	50	16.7	1.7
0.125	45	15.0	
0.15	50	16.7	
0.175	55	18.3	
0.2	60	20.0	1.3
0.3	80	26.7	1.4
0.4	85	28.3	1.2
0.5	95	31.7	1.2



Sample 2 (25 Blows)

Water Content

Wt. Wet Soil+Tare, gms. 419.7 Wt. Soil+Tare, gms. 374.2 Wt. Tare, gms. 132.7 Moisture, % 18.8

Unit Weight

Wt. Mold+Soil, gms. 8171.3 Wt. Mold, gms. 4194.1 Ht. Soil, in. 4 Density, pcf 112.7

Swell Data

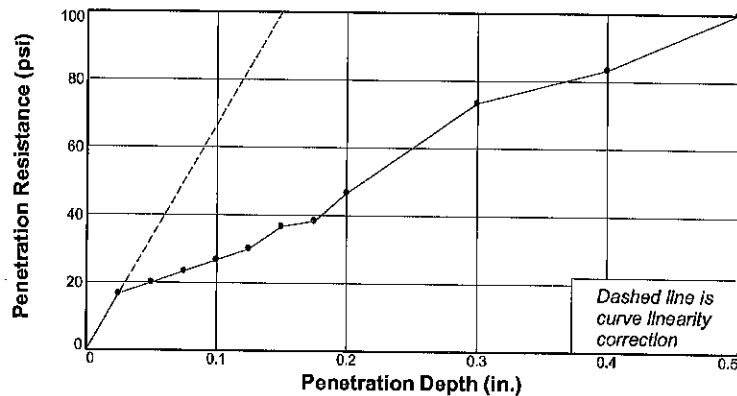
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	596	0.0
96	85	-12.8

Final Water Content

Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1) 419.7	374.2	132.7	18.8

Penetration Test Data

Pen. In.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	50	16.7	
0.05	60	20.0	
0.075	70	23.3	
0.1	80	26.7	2.7
0.125	90	30.0	
0.15	110	36.7	
0.175	115	38.3	
0.2	140	46.7	3.1
0.3	220	73.3	3.9
0.4	250	83.3	3.6
0.5	300	100.0	3.8



Sample 3 (56 Blows)

Water Content

Wt. Wet Soil+Tare, gms. 388.9 Wt. Soil+Tare, gms. 354.6 Wt. Tare, gms. 139.7 Moisture, % 16.0

Unit Weight

Wt. Mold+Soil, gms. 6834.2 Wt. Mold, gms. 2738.8 Ht. Soil, in. 4 Density, pcf 119.0

Swell Data

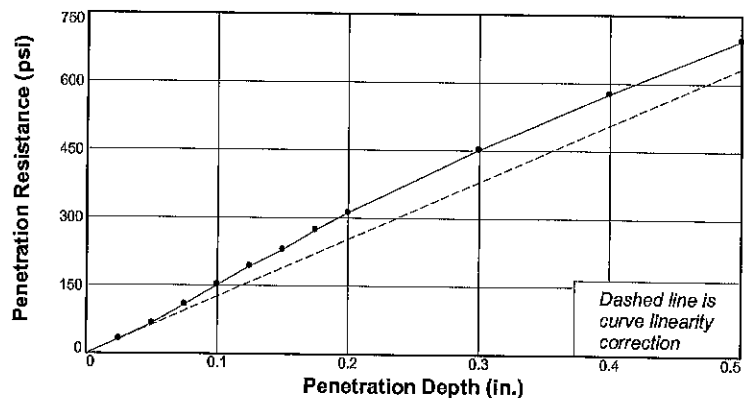
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	643	0.0
96	832	4.7

Final Water Content

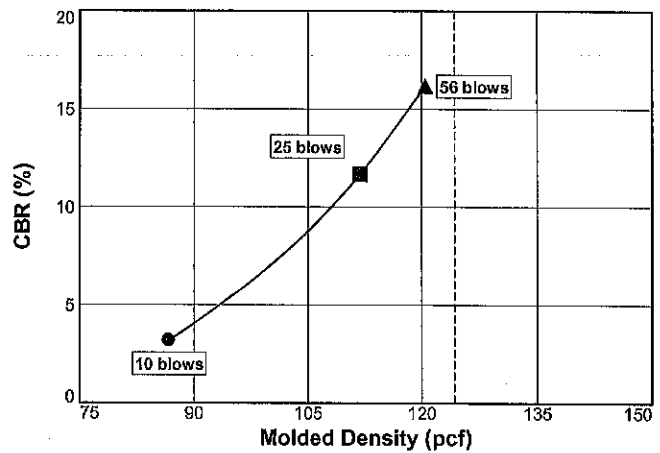
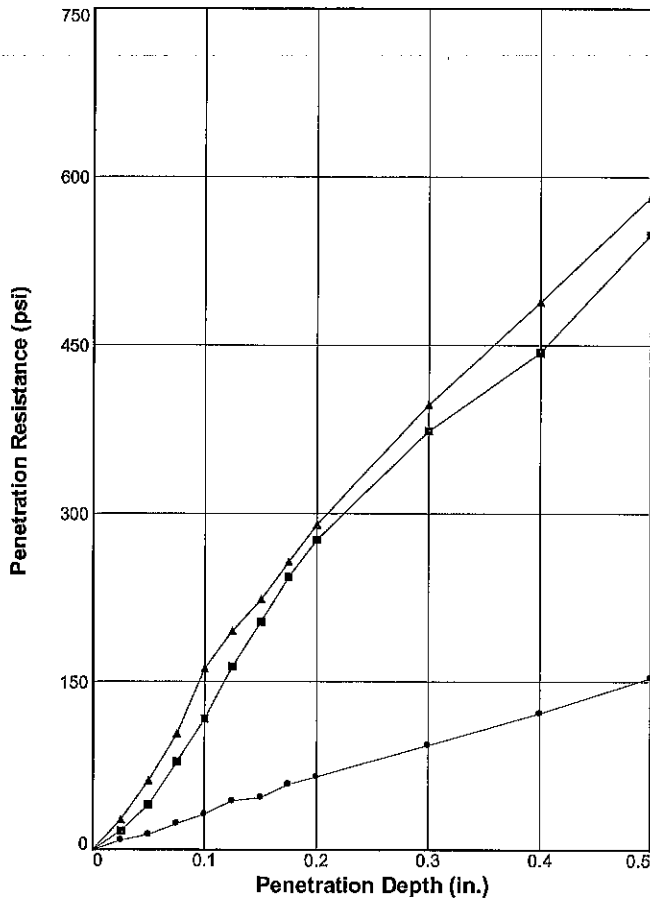
Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1) 388.9	354.6	139.7	16.0

Penetration Test Data

Pen. In.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	95	31.7	
0.05	200	66.7	
0.075	325	108.3	
0.1	455	151.7	15.2
0.125	580	193.3	
0.15	690	230.0	
0.175	820	273.3	
0.2	935	311.7	20.8
0.3	1355	451.7	23.8
0.4	1730	576.7	25.1
0.5	2085	695.0	26.7



BEARING RATIO TEST REPORT ASTM D1883-05



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	86.8	69.9	17.6	72.5	58.3	17.6	3.2	4.3	0.000		19.7
2 △	120.5	97	15.2	120.5	97	15.2	16.2	19.3	0.000		0
3 □	111.9	90.1	15.1	107.2	86.3	15.1	11.7	18.4	0.000		4.4
Material Description							USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Silty sand with gravel							SM	124.2	9.7	NV	NP

Project No: R20215509C1
Project: WEED AIRPORT PROJECT
Location: 5013-03-1/B-8 THRU B-9 BULK

Date: 12/14/21



Test Description/Remarks:

Figure _____

Tested By: C. Byer

BEARING RATIO TESTING RESULTS (ASTM D1883-05)

Date: 12/14/21
Project No.: R20215509C1
Project: WEED AIRPORT PROJECT
Location: 5013-03-1/B-8 THRU B-9 BULK
Material Description: Silty sand with gravel
USCS Classification: SM
Liquid Limit: NV **Plasticity Index:** NP

Test Description:
Maximum Dry Density, pcf: 124.2 **Optimum Moisture Content, %:** 9.7
Testing Remarks:

Sample 1 (10 Blows)

Water Content

Wt. Wet Soil+Tare, gms. 445.1 Wt. Soil+Tare, gms. 398.1 Wt. Tare, gms. 131.6 **Moisture, % 17.6**

Unit Weight

Wt. Mold+Soil, gms. 6548.3 Wt. Mold, gms. 3518.2 Ht. Soil, in. 4 **Density, pcf 86.8**

Swell Data

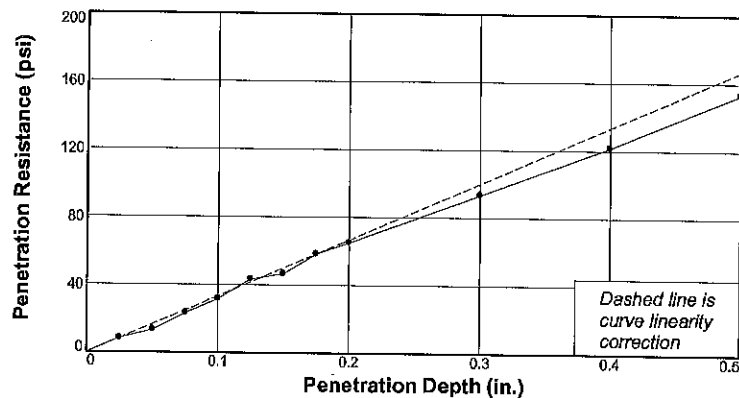
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	94	0.0
96	883	19.7

Final Water Content

	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	445.1	398.1	131.6	17.6

Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	25	8.3	
0.05	40	13.3	
0.075	70	23.3	
0.1	95	31.7	3.2
0.125	130	43.3	
0.15	140	46.7	
0.175	175	58.3	
0.2	195	65.0	4.3
0.3	280	93.3	4.9
0.4	365	121.7	5.3
0.5	460	153.3	5.9



Sample 2 (56 Blows)**Water Content**

Wt. Wet Soil+Tare, gms. 394.1 Wt. Soil+Tare, gms. 360.1 Wt. Tare, gms. 135.8

Moisture, % 15.2

Unit Weight

Wt. Mold+Soil, gms. 8316.0 Wt. Mold, gms. 4197.6 Ht. Soil, in. 4

Density, pcf 120.5

Swell Data

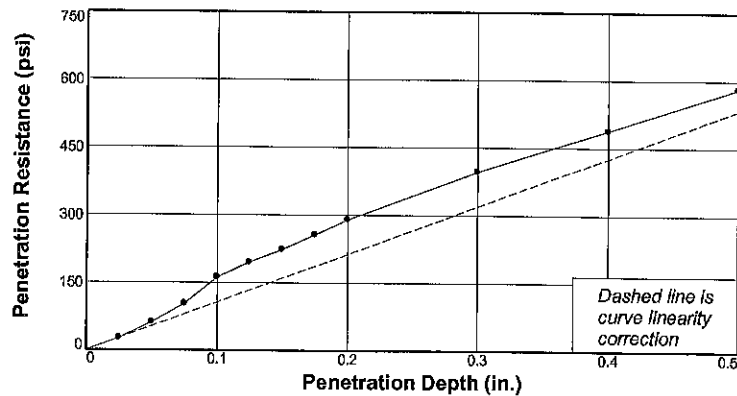
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	700	0.0
96	241	-11.5

Final Water Content

Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1) 394.1	360.1	135.8	15.2

Penetration Test Data

Pen. In.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	80	26.7	
0.05	185	61.7	
0.075	310	103.3	
0.1	485	161.7	16.2
0.125	585	195.0	
0.15	670	223.3	
0.175	770	256.7	
0.2	870	290.0	19.3
0.3	1190	396.7	20.9
0.4	1465	488.3	21.2
0.5	1745	581.7	22.4

**Sample 3 (25 Blows)****Water Content**

Wt. Wet Soil+Tare, gms. 356.5 Wt. Soil+Tare, gms. 328.0 Wt. Tare, gms. 139.0

Moisture, % 15.1

Unit Weight

Wt. Mold+Soil, gms. 6842.6 Wt. Mold, gms. 3020.7 Ht. Soil, in. 4

Density, pcf 111.9

Swell Data

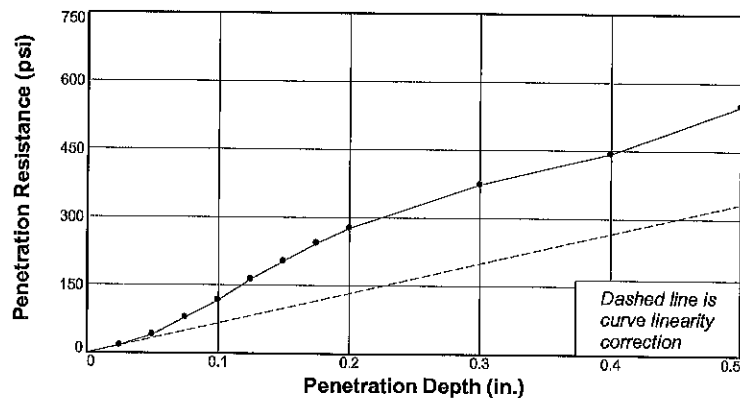
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	150	0.0
96	325	4.4

Final Water Content

Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1) 356.5	328.0	139.0	15.1

Penetration Test Data

Pen. In.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	50	16.7	
0.05	120	40.0	
0.075	235	78.3	
0.1	350	116.7	11.7
0.125	490	163.3	
0.15	610	203.3	
0.175	730	243.3	
0.2	830	276.7	18.4
0.3	1120	373.3	19.6
0.4	1330	443.3	19.3
0.5	1645	548.3	21.1



APPENDIX D

CHEMICAL TEST RESULTS



Silver State Labs-Reno
1135 Financial Blvd
Reno, NV 89502
(775) 857-2400 FAX: (888) 398-7002
www.ssalabs.com

January 05, 2022
Workorder **21110040**

Vimal P. Vimalaraj
Corestone Engineering, Inc.
1345 Capital Blvd., Ste. B
Reno, NV 89502

Project: 5013-03-1; B-08 A 0'

Dear Vimal P. Vimalaraj:

It is the policy of Silver State Analytical Laboratory - Reno to strictly adhere to a comprehensive Quality Assurance Plan that ensures the data presented in this report are both accurate and precise. Silver State Analytical Laboratory - Reno maintains accreditation in the State of Nevada (NV-00015) and the State of California (ELAP 2990).

The data presented in this report was obtained from the analysis of samples received under a chain of custody. Unless otherwise noted below, samples were received in good condition, properly preserved and within the hold time for the requested analyses. Any anomalies associated with the analysis of the samples have been flagged in the Analytical Report with an appropriate explanation in the Definitions & Qualifiers.

21110040: TPHP/E 8015 has been Sub Contracted.

Revised Report.

Sincerely,

Carly Wood
Laboratory Director
1135 Financial Blvd
Reno, NV 89502



Silver State Labs-Reno
1135 Financial Blvd
Reno, NV 89502
(775) 857-2400 FAX: (888) 398-7002
www.ssalabs.com

Analytical Report

Workorder#: 21110040
Date Reported: 1/5/2022

Client: Corestone Engineering, Inc.
Project Name: 5013-03-1; B-08 A 0'
PO #:

Sampled By: Vimal

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
21110040-01	5013-03-1; B-08 A 0'	10/20/2021 9:00	11/1/2021

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	7	mg/Kg	5	MA	11/13/2021 2:20	
pH	SW-846 9045D	6.95	pH Units		AC	11/08/2021 9:32	
pH Temperature	SW-846 9045D	20.0	°C		AC	11/08/2021 9:32	
Resistivity	EPA 120.1	5000	Ohms-cm		AC	11/08/2021 11:24	
Sulfate	EPA 9056	110	mg/Kg	2	MA	11/13/2021 2:20	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
21110040-02	5013-03-1; B-11 A 0'	10/20/2021 14:00	11/1/2021

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
TPH Extractables	EPA 8015	See Report			CW		
TPH Purgables	EPA 8015	See Report			CW		

Quality Control Report

WO#: 21110040
1/5/2022

Analysis: PASTE pH
Method: SW-846 9045D

Batch ID: R59952

Laboratory Control Sample (LCS)

RunID: 59952 SeqNo 1460044 Units: pH Units
Analysis Date: 11/8/2021 9:32:00 AM Analyst: AC

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
pH	7.020	7.05	100								

Analysis: Anions 300.0 Solid
Method: EPA 9056

Batch ID: R60231

Method Blank

RunID: 60231 SeqNo 1467049 Units: mg/Kg
Analysis Date: 11/5/2021 2:36:00 PM Analyst: JF

Analyte	Result	Rep Limit	Rep Qual
Chloride	< 0.50	0.50	
Sulfate	< 0.20	0.20	

Method Blank

RunID: 60231 SeqNo 1467115 Units: mg/Kg
Analysis Date: 11/5/2021 5:22:00 PM Analyst: JF

Analyte	Result	Rep Limit	Rep Qual
Chloride	< 0.50	0.50	
Sulfate	< 0.20	0.20	

Laboratory Control Sample (LCS)

RunID: 60231 SeqNo 1467050 Units: mg/L
Analysis Date: 11/5/2021 6:24:00 PM Analyst: JF

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Chloride	10.00	9.6	96.4								
Sulfate	10.00	9.6	95.7								

Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

Sample Spiked: 21110038-01A

RunID: 60231 SeqNo 1467100 Units: mg/Kg
Analysis Date: 11/13/2021 1:15:00 AM Analyst: JF

Analyte	Sample Result	MS Spike Added	MS Result	MS % Recovery	MSD Spike Added	MSD Result	MSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Chloride	5.856	100.0	100	97.4	100.0	100	95.9	1.48	20	90	110	
Sulfate	22.43	100.0	120	96.1	100.0	120	94.2	1.68	20	90	110	



Alpha Analytical, Inc.
255 Glendale Ave, #21
Sparks, Nevada 89431
TEL: (775) 355-1044 FAX: (775) 355-0406
Website: www.alpha-analytical.com

November 10, 2021

Joe Nava
Silver State Analytical Laboratories
1135 Financial Blvd
Reno, NV 89502
TEL: (775) 857-2400
FAX: (888) 398-7002
RE: 21110040

Order No.: SSL2111079

Dear Joe Nava:

The result of this report apply to the sample(s) as received.

There were no problems with the analytical events associated with this report unless noted.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

A handwritten signature in black ink that reads "Randy Gardner".

Randy Gardner
Laboratory Director
255 Glendale Ave, #21
Sparks, Nevada 89431



Alpha Analytical, Inc.
255 Glendale Ave, #21
Sparks, Nevada 89431
TEL: (775) 355-1044 FAX: (775) 355-0406
Website: www.alpha-analytical.com

Analytical Report

WO#: SSL2111079

Report Date: 11/10/2021

CLIENT: Silver State Analytical Laboratories

Collection Date: 10/20/2021 2:00:00 PM

Project: 21110040

Lab ID: 2111079-01

Matrix: SOIL

Client Sample ID: 5013-03-1; B-11 A 0'

Analyses	Result	RL	Qual	Units	Date Analyzed	Method
TPH-E (DRO)	75	25	Z	mg/Kg	11/3/2021	TPH-E by EPA 8015C
TPH-E (ORO)	700	50		mg/Kg	11/3/2021	TPH-E by EPA 8015C
Surr: Nonane	98	66-134		%Rec	11/3/2021	TPH-E by EPA 8015C
TPH-P (GRO)	ND	10		mg/Kg	11/2/2021	TPH-P by EPA 8015C
Surr: 1,2-Dichloroethane-d4	96	70-130		%Rec	11/2/2021	TPH-P by EPA 8015C
Surr: Toluene-d8	100	70-130		%Rec	11/2/2021	TPH-P by EPA 8015C
Surr: 4-Bromofluorobenzene	99	70-130		%Rec	11/2/2021	TPH-P by EPA 8015C



Alpha Analytical, Inc.
255 Glendale Ave, #21
Sparks, Nevada 89431
TEL: (775) 355-1044 FAX: (775) 355-0406
Website: www.alpha-analytical.com

QC SUMMARY REPORT

WO#: 2111079

10-Nov-21

Client: Silver State Analytical Laboratories

Project: 21110040

TestCode: TPH/E_S

Sample ID: MB-14198			SampType: MBLK			TestCode: TPH/E_S			Units: mg/Kg		
Client ID: PBS			Batch ID: 14198			TestNo: SW8015			SW8015		
Prep Date: 11/1/2021			RunNo: 12986			SeqNo: 360886					
Analysis Date: 11/1/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPH-E (DRO)	ND	5									
TPH-E (ORO)	ND	10									
Surr: Nonane	5.9		6		98.4	66	134				

Sample ID: LCSD-14198			SampType: LCSD			TestCode: TPH/E_S		Units: mg/Kg			
Client ID: LCSS02			Batch ID: 14198			TestNo: SW8015		SW8015			
Prep Date: 11/1/2021			RunNo: 12986			SeqNo: 360888					
Analysis Date: 11/1/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPH-E (DRO)	104	5	100	0	104	79.4	120.49	105	0.72	37.9	
Surr: Nonane	6.05		6		101	78	138	6.05	0	37.9	

Sample ID: LCS-14198			SampType: LCS			TestCode: TPH/E_S		Units: mg/Kg			
Client ID: LCSS			Batch ID: 14198			TestNo: SW8015		SW8015			
Prep Date: 11/1/2021			RunNo: 12986			SeqNo: 360887					
Analysis Date: 11/1/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPH-E (DRO)	105	5	100	0	105	79.4	120.49				
Surr: Nonane	6.05		6		101	78	138				

Qualifiers: B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S Spike Recovery outside accepted recovery limits



Alpha Analytical, Inc.
255 Glendale Ave, #21
Sparks, Nevada 89431
TEL: (775) 355-1044 FAX: (775) 355-0406
Website: www.alpha-analytical.com

QC SUMMARY REPORT

WO#: 2111079

10-Nov-21

Client: Silver State Analytical Laboratories

Project: 21110040

TestCode: TPH/P_S

Sample ID: MB-14205			SampType: MBLK			TestCode: TPH/P_S			Units: mg/Kg		
Client ID: PBS			Batch ID: A14205B			TestNo: SW8015					
Prep Date: 11/3/2021			RunNo: 13010			SeqNo: 361563					
Analysis Date: 11/3/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPH-P (GRO)	ND	1									
Surr: 1,2-Dichloroethane-d4	0.19		0.2		93.5	69.51	130.49				
Surr: Toluene-d8	0.21		0.2		107	69.51	130.49				
Surr: 4-Bromofluorobenzene	0.19		0.2		95.4	69.51	130.49				

Sample ID: GLCS-14205			SampType: GLCS			TestCode: TPH/P_S		Units: mg/Kg			
Client ID: BatchQC			Batch ID: A14205B			TestNo: SW8015					
Prep Date: 11/2/2021			RunNo: 12999			SeqNo: 361261					
Analysis Date: 11/2/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPH-P (GRO)	14.9	2	16	0	92.9	64.64	146.49				
Surr: 1,2-Dichloroethane-d4	0.371		0.4		92.6	69.51	130.49				
Surr: Toluene-d8	0.409		0.4		102	69.51	130.49				
Surr: 4-Bromofluorobenzene	0.428		0.4		107	69.51	130.49				

Sample ID: 2111030-01AGSD			SampType: GSD			TestCode: TPH/P_S		Units: mg/Kg			
Client ID: BatchQC			Batch ID: A14205B			TestNo: SW8015					
Prep Date: 11/2/2021			RunNo: 12999			SeqNo: 361263					
Analysis Date: 11/2/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPH-P (GRO)	13.5	2	16	0	84.2	57.6	179	14.7	8.9	19.4	
Surr: 1,2-Dichloroethane-d4	0.369		0.4		92.4	69.51	130.49	0.378	0	0	
Surr: Toluene-d8	0.412		0.4		103	69.51	130.49	0.415	0	0	
Surr: 4-Bromofluorobenzene	0.435		0.4		109	69.51	130.49	0.43	0	0	

Sample ID: 2111030-01AGS			SampType: GS			TestCode: TPH/P_S		Units: mg/Kg			
Client ID: BatchQC			Batch ID: A14205B			TestNo: SW8015					
Prep Date: 11/2/2021			RunNo: 12999			SeqNo: 361262					
Analysis Date: 11/2/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPH-P (GRO)	14.7	2	16	0	92.1	57.6	179				
Surr: 1,2-Dichloroethane-d4	0.378		0.4		94.4	69.51	130.49				
Surr: Toluene-d8	0.415		0.4		104	69.51	130.49				
Surr: 4-Bromofluorobenzene	0.43		0.4		107	69.51	130.49				

Qualifiers: B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S Spike Recovery outside accepted recovery limits



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QC SUMMARY REPORT

WO#: 2111079

10-Nov-21

Client: Silver State Analytical Laboratories

Project: 21110040

TestCode: TPH/P_S

Sample ID: 2111030-01AGS				SampType: GS		TestCode: TPH/P_S		Units: mg/Kg			
Client ID: BatchQC				Batch ID: A14205B		TestNo: SW8015					
Prep Date: 11/2/2021				RunNo: 12999		SeqNo: 361262					
Analysis Date: 11/2/2021											
Analyte	Result	PQL	SPK Value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers: B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S Spike Recovery outside accepted recovery limits



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Definition Only

WO#: 2111079
Date: 11/3/2021

Definitions:

ND = Not Detected

C = Reported concentration includes additional compounds uncharacteristic of common fuels and lubricants.

D = Reporting Limits were increased due to high concentrations of non-target analytes.

H = Reporting Limits were increased due to the hydrocarbons present in the sample.

J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

K = DRO concentration may include contributions from lighter-end hydrocarbons (e.g. gasoline) that elute in the DRO range.

L = DRO concentration may include contributions from heavier-end hydrocarbons (e.g. motor oil) that elute in the DRO range.

O = Reporting Limits were increased due to sample foaming.

V = Reporting Limits were increased due to high concentrations of target analytes.

X = Reporting Limits were increased due to sample matrix interferences.

Z = DRO concentration may include contributions from lighter-end (e.g. gasoline) and heavier-end (e.g. motor oil) hydrocarbons that elute in the DRO range.

S50 = The analysis of the sample required a dilution such that the surrogate concentration was diluted below the laboratory acceptance criteria. The laboratory control sample was acceptable.

S51 = Surrogate recovery could not be determined due to the presence of co-eluting hydrocarbons.

S52 = Surrogate recovery was above laboratory acceptance limits. Probable matrix effect.

S53 = Surrogate recovery was below laboratory acceptance limits. Probable matrix effect.

S54 = Surrogate recovery was below laboratory acceptance limits.

S55 = Surrogate recovery was above laboratory acceptance limits.

Report CC's Carly Wood
Joe Nava

WORKORDER SUMMARY

Alpha Analytical, Inc.

255 Glendale Ave, #21 Sparks, Nevada 89431

TEL: (775) 355-1044 FAX: (775) 355-0406

NV

RUSH

WorkOrder: SSL2111079

Report Due By: 03-Nov-21

EDD Required: NO

Report Attention: Joe Nava

Client:

Silver State Analytical Laboratories
1135 Financial Blvd
Reno, NV 89502

TEL: (775) 857-2400

FAX: (888) 398-7002

ProjectNo: 21110040

Date Received: 02-Nov-21

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles			Requested Tests							Sample Remarks
				Alpha	Sub	TAT	TPH/E_S	TPH/P_S						
SSL2111079-01	5013-03-1; B-11 A 0'	SO	10/20/2021 2:00:00 PM	1	0	1	A - TPH/E_N	A - GAS-N						

Comments: 24 HR TAT, in order to meet holding time per Sydney.

Signature	Print Name	Company	Date/Time
Logged in by: <u>K Murray</u>	<u>K Murray</u>	Alpha Analytical, Inc.	11.2.21 1305

NOTE: Samples are discarded 60 days after sample receipt unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other



CHAIN-OF-CUSTODY-RECORD

Page 1 of 1

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Definitions:

LCS: Laboratory Control Sample; prepared by adding a known mass of target analytes to a specified amount of de-ionized water and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: LCS Duplicate; used to calculate both Accuracy (%REC) and Precision (%RPD)

MBLK: Method Blank; a sample of similar matrix that is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

MS: Matrix Spike; prepared by adding a known mass of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: Matrix Spike Duplicate; used to calculate both Accuracy (%REC) and Precision (%RPD)

RPD: Relative Percent Difference; comparison between sample and duplicate and/or MS and MSD.

PQL: Practical Quantitation Limit; the limit to which data is quantitated for reporting.

MDL: Method Detection Limit; the limit to which the instrument can reliably detect.

MCL: Maximum Contaminant Level; value set according to EPA guidelines.

Qualifiers:

* - Analyte exceeds Safe Drinking Water Act MCL, does not meet drinking water standards.

C - Analyte value below Safe Drinking Water Act MCL, does not meet drinking water standards.

B - Analyte found above the PQL in associated method blank.

G - Calibration blank analyte detected above PQL.

H - Sample analyzed beyond holding time for this parameter.

J - Estimated Value; Analyte found between MDL and PQL limits.

L - Sample concentration is at least 5 times greater than spike contribution. Spike recovery criteria do not apply.

R - RPD between sample and duplicate sample outside the RPD acceptance limits.

S - Batch MS and/or MSD were outside acceptance limits, batch LCS was acceptable.

W - Sample temperature when received was out of limit as specified by method.

Z - Batch LCS and/or LCSD were outside acceptance limits.