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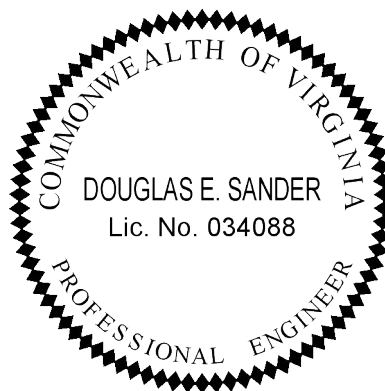
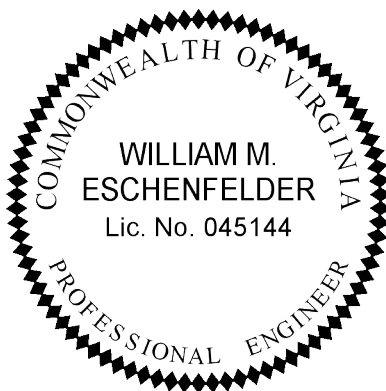
PROJECT MANUAL
VOLUME 2 OF 2

REHABILITATE RUNWAY 6-24

ROANOKE-BLACKSBURG AIRPORT
ROANOKE, VIRGINIA

AIP PROJECT NO. 3-51-0045-074-2025 (DESIGN)
AIP PROJECT NO. PENDING (CONSTRUCTION)
RRAC BID NO. 26-013

PREPARED FOR THE
ROANOKE REGIONAL AIRPORT COMMISSION



**REHABILITATE RUNWAY 6-24
PROJECT BID NO: 26-013**

**PROJECT MANUAL
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for

Rehabilitate Runway 6-24

at

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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:

Paragraph 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).
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.

Paragraph Number	Term	Definition
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.
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, Construction Agreement, Proposal, Performance bond, Payment Bond, general provisions, certifications and representations, Specifications, Plans, Special Provisions, supplemental provisions, standards incorporated by reference and issued Addenda.
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.

Paragraph Number	Term	Definition
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 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.

Paragraph Number	Term	Definition
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 paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.
10-32	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 the Roanoke Regional Airport Commission.
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.

Paragraph Number	Term	Definition
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 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," "drawings," "plan sheets," or "exhibits."
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.
10-51	Runway	The area on the airport prepared for the landing and takeoff of aircraft.

Paragraph Number	Term	Definition
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 Engineer, 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.
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.

Paragraph Number	Term	Definition
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.
	Owner Defined Terms:	
10-66	Addenda	Written or graphic instruments issued prior to the opening of bids which clarify, correct, or change the bidding documents or the contract documents and become a part thereof.
10-67	Bid	The Bidder's formal offer, written and submitted on the prescribed forms, to perform the work for the project at a specified cost based on the terms and conditions outlined in the Bidding Documents.
10-68	Bidding Documents	The Bidding Documents include the invitation for bids/advertisement; instructions to bidders; bid forms and supplements (including but not limited to the bid form; bid schedule(s); and all bid certifications and disclosures); bid bond or other accepted forms of bid security; proposed Contract Documents; and issued Addenda.
10-69	Contract Documents	The Contract Documents include the Bid submitted by the awarded Contractor; the Project Manual, other than the supplemental resource material included in the appendices which provide geotechnical and existing conditions information; the Plans; and issued Addenda.
10-70	FAA Advisory Circular (AC)	A document prepared by the Federal Aviation Administration to provide guidance and information in a designated aviation related subject area, including standards, materials, and/or methods. The most current edition of ACs, approved by the FAA, can be found on the FAA web site at https://www.faa.gov/regulations_policies/advisory_circulars/
10-71	Install	Unless described otherwise in the plans or specifications, "install" shall mean to furnish the item(s) referenced and to provide all materials, labor, equipment, and tools necessary to establish the referenced items(s) in place and in the correct working order.

Paragraph Number	Term	Definition
10-72	Notice of Award	The written notice by the Owner to the apparent low bidder that they are the successful bidder and, that upon compliance with the contract conditions, the Owner intends to execute the contract with the apparent low bidder.
10-73	Project Manual	A comprehensive written manual consisting of the documents that define the technical, contractual, and administrative requirements for procuring and constructing the project. Contents may be bound in one or more volumes.
10-74	Shop Drawings	All drawings, diagrams, illustrations, schedules, and other data which are prepared by the Contractor, a subcontractor, manufacturer, supplier, or distributor and which illustrate the equipment, material or some portion of the work. All shop drawings shall be approved by the Contractor and submitted to the Engineer for review and acceptance for reasonable conformance to the contract documents.
10-75	Subcontractor	An individual, firm or corporation having a direct contract with the Contractor or with any other subcontractor for the performance of a part of the work at the site.
10-76	Substantial Completion	The work has progressed to the point where, in the opinion of the Owner as evidenced by the Engineer's definitive Certificate of Substantial Completion, it is sufficiently complete in accordance with the contract documents, so that the work can be utilized for the purposes for which it is intended.
10-77	Virginia Department of Transportation (VDOT) Road and Bridge Specifications	The Virginia Department of Transportation Road and Bridge Specifications, current edition, utilized for highway construction. These specifications may be incorporated by reference in some of the technical specifications for this project and shall have the same force and effect as if included in the contract physically.
10-78	Virginia Department of Transportation (VDOT) Standard Drawings	The Virginia Department of Transportation Standard Drawings, current edition, utilized for highway construction. These standards may be incorporated by reference in some of the plans and technical specifications for this project and shall have the same force and effect as if included in the contract physically.

END OF SECTION 10

Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders).

A copy of the advertisement for the project has been incorporated in the front of this Project Manual.

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 their financial responsibility. 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.

Unless otherwise specified, a bidder may submit evidence that they are prequalified with the State Highway Division and are on the current "bidder's list" of the state in which the proposed work is located. Evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

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 paragraph 20-09, *Irregular proposals*.

Mobilization is limited to the percentage specified in Item C-105, paragraph 105-2, *Mobilization Limit*.

A prebid conference will be held for this project to discuss as a minimum, the following items: material requirements; submittals; Quality Control/Quality Assurance requirements; the construction safety and phasing plan including airport access and staging areas; and unique airfield paving construction requirements.

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 Section 40, paragraph 40-02, *Alteration of Work and Quantities*, 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 with regard 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. See Instructions to Bidders.

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. See Instructions to Bidders.

20-11 Delivery of proposal. See Instructions to Bidders.

20-12 Withdrawal or revision of proposals. See Instructions to Bidders.

20-13 Public opening of proposals. See Invitation For Bids

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 paragraph 20-04, *Issuance of Proposal Forms*, of this section.

20-15 Discrepancies and Omissions. See Instructions to Bidders.

END OF SECTION 20

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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, paragraph 20-09, *Irregular Proposals*.
- b. If the bidder is disqualified for any of the reasons specified Section 20, paragraph 20-14, *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. See Instruction to Bidders.

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 paragraph 30-07, *Approval of Contract*.

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 paragraph 30-01, *Consideration of Proposals*. 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 paragraph 30-05, *Requirements of Contract Bonds*.

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. See Instructions to Bidders.

30-07 Approval of contract. See Instructions to Bidders.

30-08 Failure to execute contract. See Instructions to Bidders.

END OF SECTION 30

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Section 40 Scope of Work

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

40-02 Alteration of work and quantities. The Owner reserves 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, paragraph 90-03, *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.

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 Section 90, paragraph 90-04, *Payment for Omitted Items*.

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 Engineer's opinion, is necessary for completion of the extra work.

When determined by the Engineer to be in the Owner's best interest, the Engineer may order the Contractor to proceed with extra work as provided in Section 90, paragraph 90-05, *Payment for Extra Work*. 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 Section 10, paragraph 10-59, *Supplemental Agreement*.

If extra work is essential to maintaining the project critical path, Engineer may order the Contractor to commence the extra work under a Time and Material contract method. Once sufficient detail is available to establish the level of effort necessary for the extra work, the Owner shall initiate a change order or supplemental agreement to cover the extra work.

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 Section 80, paragraph 80-04, Limitation of Operations. 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 Section 70, paragraph 70-15, *Contractor's Responsibility for Utility Service and Facilities of Others*.

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. Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.

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

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

Except as provided in Section 40, paragraph 40-07, *Rights in and Use of Materials Found in the Work*, 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 Engineer and is in conformance with the contract specifications applicable to such use; or,
- b. Remove such material from the site, upon written approval of the Engineer; or
- c. Use such material for the Contractor's own temporary construction on site; or,
- d. Use such material as intended by the terms of the contract.

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

Should the Engineer approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at 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 Engineer approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of 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.

END OF SECTION 40

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Section 50 Control of Work

50-01 Authority of the Engineer. The Engineer has final authority regarding the interpretation of project specification requirements. The Engineer 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 Engineer does not have the authority to accept work that does not conform to specification requirements.

50-02 Conformity with plans and specifications. See General Conditions

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 Engineer 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. See the Special Provisions section of the specification.

50-05 Cooperation of Contractor. The Contractor shall be supplied with five hard copies or 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 Engineer 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 Engineer or their authorized representative.

50-06 Cooperation between Contractors. See General Conditions.

50-07 Construction layout and stakes. The Engineer 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 the Engineer. 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 Engineer 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 Engineer. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the Engineer for each area of construction and for each placement of material as specified to allow the Engineer to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the Engineer prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in the following format(s): AutoCAD 2018 or newer.

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 Engineer 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 Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

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

Provide advance written notice to the Engineer 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 Engineer 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. See General Conditions.

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 paragraph 50-12, *Maintenance during Construction*, the Engineer shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the Engineer's notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner shall be recovered as a liquidated damage against the Contractor.

50-14 Partial acceptance. See General Conditions.

50-15 Final acceptance. See General Conditions.

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 Engineer 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 Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the Engineer who will present it to the Owner for consideration in accordance with local laws or ordinances.

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.

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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 Engineer 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 Engineer'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 Engineer before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the Engineer shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the Engineer, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance 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 Engineer. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the Engineer.

A copy of all Contractor QC test data shall be provided to the Engineer daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the Engineer showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

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 Engineer 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 Engineer.

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

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

60-04 Plant inspection. The Engineer or 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 Engineer conduct plant inspections, the following conditions shall exist:

- a. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.
- b. The Engineer shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.
- c. If required by the Engineer, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. 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 Engineer shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 Engineer/ Resident Project Representative (RPR) field office. The Contractor shall provide dedicated space for the use of the Engineer, RPR, and inspectors, as a field office for the duration of the project. This space shall be located conveniently near the construction and shall be separate from any space used by the Contractor. The Contractor shall furnish water, sanitary facilities, heat, air conditioning, and electricity.

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 Engineer. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans 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 Engineer. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for

the storage of materials on private property. Upon request, the Contractor shall furnish the Engineer a copy of the property Owner's permission.

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

60-07 Unacceptable materials. See General Conditions.

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.

A listing of utilities or other facilities which may be encountered during the work has been provided below.

Facility or Utility	Person to Contact (Name and Title)	Telephone/Email
Airport Operations	BJ Nipper	(540) 797-3094
FAA NAVAIDS / FAA Sector Field Office	Arnold Fouch	(540) 265-2294
Airfield Runway and Taxiway Lighting	Jay Ball	(540) 362-1999
FAA Control Tower	Trisha Newberry	(540) 265-2280
National Weather Service	William Riehl	(540) 552-0084
Virginia 811	N/A	811 or 1-800-552-7001 www.va811.com
Verizon	Business Office	(800) 837-4966
Appalachian Power Company	Business Office	(800) 956-4237
Roanoke Gas Co.	Gas Leak Reporting	(540) 777-0623
Cox Cable Roanoke	Technical Support	(866) 272-5111

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

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging

and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the Engineer, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal 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, paragraph 40-05, Maintenance of Traffic, and shall limit such operations for the convenience and safety of the traveling public as specified in Section 80, paragraph 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 Engineer. If the Engineer 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 Engineer 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 included in the Appendices.

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 shall be 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 the work indicated in the CSPP and the project plans, such portion shall be accepted by the Owner in accordance with Section 50, paragraph 50-14, *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 Engineer, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at 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 Engineer’s final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with Section 50, paragraph 50-14, *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 paragraph 70-04, 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.

See paragraph 70-04 for a list of all known services or utility providers with associated contact information.

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~~ paragraph 70-04, *Restoration of Surfaces Disturbed by Others*. A copy of each notification shall be given to the Engineer.

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

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

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

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

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

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or 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 Owner a minimum of seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

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

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

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

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

70-17 Personal liability of public officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, 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 Engineer. The Engineer will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in Section 40, paragraph 40-04, *Extra Work*, and Section 90, paragraph 90-05, *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, paragraph 80-07, *Determination and Extension of Contract Time*.

70-21 Insurance Requirements. See General Conditions and Contract Forms.

END OF SECTION 70

Section 80 Execution and Progress

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

The Contractor shall perform, with his organization, an amount of work equal to at least 51 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 Engineer 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.
- DBE/non-DBE status.

80-02 Notice to proceed (NTP). See General Conditions.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their coordinated construction schedule showing all work activities for the Engineer's review and acceptance at least 10 days prior to the Preconstruction Conference. The Contractor's progress schedule, once accepted by the Engineer, will represent the Contractor's baseline plan to accomplish the project in accordance with the terms and conditions of the Contract. The Engineer 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 Engineer's request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the Engineer at least 48 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) 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 Engineer) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the Engineer and until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, paragraph 70-08, *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) 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 detailed in the CSPP. ~~follows:~~

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 Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed 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 Engineer.

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 Engineer may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall 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 Engineer. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this 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 Engineer within the time period stated in the Engineer's order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The Engineer will forward the Contractor's claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather 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 paragraph 80-07, *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.

Schedule	Liquidated Damages Cost	Allowed Construction Time
See General Conditions		

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the contract.

80-09 Default and termination of contract. See General Conditions.

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

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

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

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

Termination of the contract or a portion thereof shall neither relieve the Contractor of 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 Engineer prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate 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 Engineer, 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 Engineer.

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

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 Engineer. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the Engineer directs, and each truck shall bear a plainly legible identification mark.
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 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.

Term	Description
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 Engineer 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. 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 Engineer can safely and conveniently view them.

Term	Description
	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 paragraph 90-05 Payment for Extra Work.
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 Engineer. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 Scope of payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of Section 70, paragraph 70-18, *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, paragraph 40-02, *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, paragraph 40-03, *Omitted Items*, the Engineer shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

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

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

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

90-05 Payment for extra work. Extra work, performed in accordance with Section 40, paragraph 40-04, *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 Engineer, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with paragraph 90-07, *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.

a. Retainage. From the total of the amount determined to be payable on a partial payment, five (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 Section 50-14. Contractor must provide a certified invoice to the Engineer 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 paragraph 90-08.

b. Payments to subcontractors. See General Conditions.

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

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

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in paragraph 90-09, *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 Engineer at or on an approved site.
- b. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.
- c. The Contractor has furnished the Engineer with satisfactory evidence that the material and transportation costs have been paid.
- d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material 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 paragraph 90-06, Partial Payments, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

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

90-09 Acceptance and final payment. When the contract work has been accepted in accordance with the requirements of Section 50, paragraph 50-15, *Final Acceptance*, the Engineer will prepare the final estimate of the items of work actually performed. The Contractor shall approve the Engineer's final estimate or advise the Engineer of the Contractor's objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended

by change order or supplemental agreement. The Contractor and the Engineer shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the Engineer's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the Engineer's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with Section 50, paragraph 50-16, *Claims for Adjustment and Disputes*.

After the Contractor has approved, or approved under protest, the Engineer's final estimate, and after the Engineer's receipt of the project closeout documentation required in paragraph 90-11, *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, paragraph 50-16, *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 Engineer approves the Contractor's final submittal. The Contractor shall:

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

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

c. Complete final cleanup in accordance with Section 40, paragraph 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.

END OF SECTION 90

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Federal Contract Provisions for FAA Funded Projects (v. 03/17/26)

Federal laws and regulations require that a Sponsor (a recipient of federal assistance) include specific provisions in certain contracts, solicitations, or specifications, regardless of whether the project is federally funded, to remain compliant with its obligations.

Unless otherwise stated, the following federally required contract provisions also flow down to subcontracts and sub-tier agreements. The Contractor (including all subcontractors) is required to insert these contract provisions in each lower tier contract (e.g., subcontract or sub-agreement). For work done under any purchase orders, rental agreements, and other agreements for supplies or services, the Contractor (including all subcontractors) is required to incorporate the requirements of these contract provisions by reference.

The prime Contractor is responsible for compliance with these contract provisions by any subcontractor, lower-tier subcontractor, or service provider.

A1: ACCESS TO RECORDS AND REPORTS

Sources: *2 CFR § 200.334; 2 CFR § 200.337; FAA Order 5100.38*

Contract Dollar Threshold: \$0

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Aviation Administration, and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

A2: BREACH OF CONTRACT TERMS

Source: *2 CFR Part 200 Appendix II (A)*

Contract Dollar Threshold: \$350,000

Any violation or breach of terms of this contract on the part of the Contractor or its subcontractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement.

Owner will provide Contractor written notice that describes the nature of the breach and corrective actions the Contractor must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner's notice will identify a specific date by which the Contractor must correct the breach. Owner may proceed with termination of the contract if the Contractor fails to correct the breach by the deadline indicated in the Owner's notice.

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights, and remedies otherwise imposed or available by law.

A3: BUY AMERICAN PREFERENCE

Sources: *Title 49 U.S.C. § 50101; Executive Order 14005, Ensuring the Future is Made in All of America by All of America's Workers; Infrastructure Investment and Jobs Act (IIJA) (P.L. No. 117-58), Build America, Buy America (BABA)*

Contract Dollar Threshold: \$0

The Contractor certifies that its bid/offer is in compliance with 49 U.S.C. § 50101, BABA and other related Made in America Laws,¹ U.S. statutes, guidance, and FAA policies, which provide that Federal funds may not be obligated unless all iron, steel and manufactured goods used in AIP funded projects are produced in the United States, unless the Federal Aviation Administration has issued a waiver for the product; the product is listed as an Excepted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list.

The bidder or offeror must complete and submit the certification of compliance with FAA's Buy American Preference, BABA and Made in America laws included herein with their bid or offer. The Airport Sponsor/Owner will reject as nonresponsive any bid or offer that does not include a completed certification of compliance with FAA's Buy American Preference and BABA.

The bidder or offeror certifies that all constructions materials, defined to mean an article, material, or supply other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives that are or consist primarily of: non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); glass (including optic glass); lumber; or drywall used in the project are manufactured in the U.S.

The bidder or offeror certifies procurement of certain rolling stock using FAA grant funds will prohibit airports from using Federal financial assistance to procure buses or rail car vehicle rolling stock from covered entities.

1: Per Executive Order 14005 "Made in America Laws" means all statutes, regulations, rules, and Executive Orders relating to federal financial assistance awards or federal procurement, including those that refer to "Buy America" or "Buy American," that require, or provide a preference for, the purchase or acquisition of goods, products, or materials produced in the United States, including iron, steel, and manufactured products offered in the United States.

Certification of Compliance with FAA Buy American Preference – Construction Projects

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with its proposal. The bidder or offeror must indicate how it intends to comply with 49 U.S.C. § 50101, BABA and other related Made in America Laws, U.S. statutes, guidance, and FAA policies, by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (i.e., not both) by inserting a checkmark (✓) or the letter “X”.

- ☐ Bidder or offeror hereby certifies that it will comply with 49 U.S.C. § 50101, BABA and other related U.S. statutes, guidance, and policies of the FAA by:
- a) Only installing iron, steel and manufactured products produced in the United States;
 - b) Only installing construction materials defined as: an article, material, or supply – other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives that are or consist primarily of non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); glass (including optic glass); lumber or drywall that have been manufactured in the United States.
 - c) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
 - d) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- a) To provide to the Airport Sponsor or the FAA evidence that documents the source and origin of the iron, steel, and/or manufactured product.
- b) To faithfully comply with providing U.S. domestic products.
- c) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.
- d) Certify that all construction materials used in the project are manufactured in the U.S.

- ☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 U.S.C. § 50101(a) but may qualify for a Type 3 or Type 4 waiver under 49 U.S.C. § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

- a) To submit to the Airport Sponsor or FAA within 15 calendar days of being selected as the responsive bidder, a formal waiver request and required documentation that supports the type of waiver being requested.
- b) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.
- c) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
- d) To furnish U.S. domestic product for any waiver request that the FAA rejects.
- e) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 2 Waiver (Nonavailability) – The iron, steel, manufactured goods or construction materials or manufactured goods are not available in sufficient quantity or quality in the United States. The required documentation for the Nonavailability waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire
- b) Record of thorough market research, consideration where appropriate of qualifying alternate items, products, or materials including;
- c) A description of the market research activities and methods used to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources.

Type 3 Waiver – The cost of components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the “facility/project.” The required documentation for a Type 3 waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire including;
- b) Listing of all manufactured products that are not comprised of 100 percent U.S. domestic content (excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
- c) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly and installation at project location.
- d) Percentage of non-domestic component and subcomponent cost as compared to total “facility” component and subcomponent costs, excluding labor costs associated with final assembly and installation at project location.

Type 4 Waiver (Unreasonable Costs) – Applying this provision for iron, steel, manufactured goods or construction materials would increase the cost of the overall project by more than 25 percent. The required documentation for this waiver is:

- a) A completed Content Percentage Worksheet and Final Assembly Questionnaire from
- b) At minimum two comparable equal bids and/or offers;
- c) Receipt or record that demonstrates that supplier scouting called for in Executive Order 14005, indicates that no domestic source exists for the project and/or component;
- d) Completed waiver applications for each comparable bid and/or offer.

False Statements: Per 49 U.S.C. § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date

Signature

Company Name

Title

Certification of Compliance with FAA Buy American Preference – Equipment/Building Projects

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 U.S.C. § 50101, BABA, and other Made in America Laws, U.S. statutes, guidance, and FAA policies by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter “X”.

☐ Bidder or offeror hereby certifies that it will comply with 49 U.S.C. § 50101, BABA and other related U.S. statutes, guidance, and policies of the FAA by:

- a) Only installing steel and manufactured products produced in the United States;
- b) Only installing construction materials defined as: an article, material, or supply – other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives that are or consist primarily of non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); glass (including optic glass); lumber or drywall that have been manufactured in the United States.
- c) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
- d) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- a) To provide to the Airport Sponsor or FAA evidence that documents the source and origin of the steel and manufactured product.
- b) To faithfully comply with providing U.S. domestic product.
- c) To furnish U.S. domestic product for any waiver request that the FAA rejects.
- d) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 U.S.C. § 50101(a) but may qualify for a Type 3 waiver under 49 U.S.C. § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

- a) To submit to the Airport Sponsor or FAA within 15 calendar days of being selected as the responsive bidder, a formal waiver request and required documentation that supports the type of waiver being requested.
- b) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.
- c) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
- d) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 2 Waiver (Nonavailability) – The iron, steel, manufactured goods or construction materials are not available in sufficient quantity or quality in the United States. The required documentation for the Nonavailability waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire
- b) Record of thorough market research, consideration where appropriate of qualifying alternate items, products, or materials including;
- c) A description of the market research activities and methods used to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources.

Type 3 Waiver – The cost of the item components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the “item”. The required documentation for a Type 3 waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire including;
- b) Listing of all product components and subcomponents that are not comprised of 100 percent U.S. domestic content (excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
- c) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
- d) Percentage of non-domestic component and subcomponent cost as compared to total “item” component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

Type 4 Waiver (Unreasonable Costs) – Applying this provision for iron, steel, manufactured goods, or construction materials would increase the cost of the overall project by more than 25 percent. The required documentation for this waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire from
- b) At minimum two comparable equal bidders and/or offerors;
- c) Receipt or record that demonstrates that supplier scouting called for in Executive Order 14005, indicates that no domestic source exists for the project and/or component;
- d) Completed waiver applications for each comparable bid and/or offer.

False Statements: Per 49 U.S.C. § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date

Signature

Company Name

Title

A4: GENERAL CIVIL RIGHTS PROVISIONS

Source: *49 U.S.C. § 47123*

Contract Dollar Threshold: \$0

In all its activities within the scope of its airport program, the Contractor agrees to comply with pertinent statutes, Executive Orders, and such rules as identified in Title VI List of Pertinent Nondiscrimination Acts and Authorities to ensure that no person shall, on the grounds of race, color, national origin, creed, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision is in addition to that required by Title VI of the Civil Rights Act of 1964.

The above provision binds the Contractor and subcontractors from the bid solicitation period through the completion of the contract.

A5: TITLE VI SOLICITATION NOTICE

Sources: *49 U.S.C. § 47123; FAA Order 1400.11*

Contract Dollar Threshold: \$0

The Sponsor, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders or offerors that it will affirmatively ensure that for any contract entered into pursuant to this advertisement, all businesses will be afforded full and fair opportunity to submit bids in response to this invitation and no businesses will be discriminated against on the grounds of race, color, national origin, creed, sex, age, or disability in consideration for an award.

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination in Federally-Assisted programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964) including amendments thereto;
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794 et seq.), as amended (prohibits discrimination on the basis of disability); and 49 CFR part 27 (Nondiscrimination on the Basis of Disability in Programs or Activities Receiving Federal Financial Assistance);
- The Age Discrimination Act of 1975, as amended (42 U.S.C. § 6101 et seq.) (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982 (49 U.S.C. § 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987 (P.L. 100-259) (broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975

and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);

- Titles II and III of the Americans with Disabilities Act of 1990 (42 U.S.C. § 12101, et seq) (prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities) as implemented by U.S. Department of Transportation regulations at 49 CFR parts 37 and 38;
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. § 1681, et seq).

Compliance with Nondiscrimination Requirements

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”), agrees as follows:

1. **Compliance with Regulations:** The Contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts and Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin, creed, sex, age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21 including amendments thereto.
3. **Solicitations for Subcontracts, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the contractor’s obligations under this contract and the Nondiscrimination Acts and Authorities on the grounds of race, color, or national origin.
4. **Information and Reports:** The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts and Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the Sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. **Sanctions for Noncompliance:** In the event of a Contractor’s noncompliance with the non-discrimination provisions of this contract, the Sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:
 - a. Withholding payments to the Contractor under the contract until the Contractor complies; and/or
 - b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the Sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the Contractor may request the Sponsor to enter into any litigation to protect the interests of the Sponsor. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

A6: CLEAN AIR AND WATER POLLUTION CONTROL

Sources: 2 CFR Part 200, Appendix II (G); 42 U.S.C. § 7401, et seq; 33 U.S.C. § 1251, et seq

Contract Dollar Threshold: \$150,000

Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act (42 U.S.C. §§ 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. §§ 1251-1387). The Contractor agrees to report any violation to the Owner immediately upon discovery. The Owner assumes responsibility for notifying the Environmental Protection Agency (EPA) and the Federal Aviation Administration.

Contractor must include this requirement in all subcontracts that exceed \$150,000.

A7: CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

Sources: 2 CFR Part 200, Appendix II(E); 29 CFR § 5.5(b)(2); 29 CFR § 5.8(a); 40 U.S.C. § 3702(c); 40 U.S.C. § 3704

Contract Dollar Threshold: \$100,000

1. Overtime Requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages.

In the event of any violation of the clause set forth in paragraph (1) of this clause, the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this clause, in the sum of \$33 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this clause.

3. Withholding for Unpaid Wages and Liquidated Damages.

The Federal Aviation Administration (FAA) or the Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this clause.

4. Subcontractors.

The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (1) through (4) and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this clause.

A8: COPELAND “ANTI-KICKBACK” ACT

Sources: *2 CFR Part 200, Appendix II(D); 29 CFR Parts 3 and 5*

Contract Dollar Threshold: \$2,000

Contractor must comply with the requirements of the Copeland “Anti-Kickback” Act (18 U.S.C. 874 and 40 U.S.C. 3145), as supplemented by Department of Labor regulation 29 CFR part 3. The Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled. The Contractor and each Subcontractor must submit to the Owner a weekly statement on the wages paid to each employee performing covered work during the prior week. The Owner must report any violations of the Act to the Federal Aviation Administration.

A9: DAVIS-BACON REQUIREMENTS

Sources: *2 CFR Part 200, Appendix II(D); 29 CFR Part 5; 49 U.S.C. § 47112(b); 40 U.S.C. §§ 3141-3144, 3146, and 3147*

Dollar Threshold: \$2,000

1. Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Secretary of Labor under regulations implementing the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or

programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination, and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination;
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the Contractor, the laborers, or mechanics to be employed in the classification, or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act

have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding.

The Federal Aviation Administration or the Sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the Contractor, Sponsor, Applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and Basic Records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records that show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR § 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead, the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/payroll-certification> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker and shall provide them upon request to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage

requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, Sponsor, or Owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i), and that such information is correct and complete;

(2) That each laborer and mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Sponsor, the Federal Aviation Administration, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the Contractor, Sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR § 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid

not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR § 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at no less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination that provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

5. Compliance with Copeland Act Requirements.

The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

6. Subcontracts.

The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR §§ 5.5(a)(1) through (10) and such other clauses as the Federal Aviation Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR § 5.5.

7. Contract Termination: Debarment.

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR § 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR § 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR § 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

A10: DEBARMENT AND SUSPENSION

Sources: 2 CFR Part 180 (Subpart B); 2 CFR Part 200, Appendix II(H); 2 CFR Part 1200; DOT Order 4200.5; Executive Orders 12549 and 12689

Contract Dollar Threshold: \$25,000

Certification of Offeror/Bidder Regarding Debarment

By submitting a bid/proposal under this solicitation, the bidder or offeror certifies that neither it nor its principals are presently debarred or suspended by any Federal department or agency from participation in this transaction.

Certification of Lower Tier Contractors Regarding Debarment

The successful bidder, by administering each lower tier subcontract that exceeds \$25,000 as a "covered transaction", must confirm each lower tier participant of a "covered transaction" under the project is not presently debarred or otherwise disqualified from participation in this federally assisted project. The successful bidder will accomplish this by:

1. Checking the System for Award Management at website: <http://www.sam.gov>.
2. Collecting a certification statement similar to the Certification of Offeror /Bidder Regarding Debarment, above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract.

If the Federal Aviation Administration later determines that a lower tier participant failed to disclose to a higher tier participant that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedies, including suspension and debarment of the non-compliant participant.

A11: DISADVANTAGED BUSINESS ENTERPRISES REQUIRED PROVISIONS

Sources: *49 CFR Part 26; 49 U.S.C. § 47113*

Dollar Threshold: \$0

A11.1: Solicitation for Proposals

The requirements of 49 CFR part 26, including any amendments, thereto apply to this contract. It is the policy of the Airport Sponsor to practice nondiscrimination based on race, color, sex, or national origin in the award or performance of this contract. The Owner encourages participation by all firms qualifying under this solicitation regardless of business size or ownership.

A11.2: Prime Contracts Covered by a DBE Program

Contract Assurance (49 CFR § 26.13)

The Contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR part 26, including any amendments thereto, in the award and administration of DOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- 1) Withholding monthly progress payments;
- 2) Assessing sanctions;
- 3) Liquidated damages; and/or
- 4) Disqualifying the Contractor from future bidding as non-responsible.

Prompt Payment (49 CFR § 26.29)

The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than seven (7) days from the receipt of each payment the prime contractor receives from the Sponsor. The prime contractor agrees further to return retainage payments to each subcontractor within seven (7) days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the Sponsor. This clause applies to both DBE and non-DBE subcontractors.

A12: TEXTING WHEN DRIVING

Sources: *Executive Order 13513; DOT Order 3902.10*

Contract Dollar Threshold: \$15,000

In accordance with Executive Order 13513, "Federal Leadership on Reducing Text Messaging While Driving," (10/1/2009) and DOT Order 3902.10, "Text Messaging While Driving," (12/30/2009), the Federal Aviation Administration encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or subgrant.

In support of this initiative, the Owner encourages the Contractor to promote policies and initiatives for its employees and other work personnel that decrease crashes by distracted drivers, including policies that ban text messaging while driving motor vehicles while performing work activities associated with the project. The Contractor must include the substance of this clause in all sub-tier contracts exceeding \$15,000 that involve driving a motor vehicle in performance of work activities associated with the project.

A13: PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT

Sources: *2 CFR Part 200, Appendix II(K); 2 CFR § 200.216*

Contract Dollar Threshold: \$0

Contractor and Subcontractor agree to comply with mandatory standards and policies relating to use and procurement of certain telecommunications and video surveillance services or equipment in compliance with the National Defense Authorization Act [P.L. 115-232, § 889(f)(1)].

A14: DRUG-FREE WORKPLACE REQUIREMENTS

Sources: *49 CFR Part 32; Drug-Free Workplace Act of 1988 (41 U.S.C. § 8101-8106, as amended)*

Not applicable to this contract.

A15: FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

Sources: *29 U.S.C. § 201, et seq; 2 CFR § 200.430*

Contract Dollar Threshold: \$0

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR Part 201, et seq, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers.

The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

A16: CERTIFICATION REGARDING LOBBYING

Source: *31 U.S.C. §1352 - Byrd Anti-Lobbying Amendment; 2 CFR Part 200 Appendix II(I); 49 CFR Part 20, Appendix A*

Contract Dollar Threshold: \$100,000

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned

shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. § 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

A17: OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

Source: *29 CFR Part 1910*

Contract Dollar Threshold: \$0

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor’s compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (29 CFR Part 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

A18: PROCUREMENT OF RECOVERED MATERIALS

Sources: *2 CFR § 200.323; 2 CFR Part 200, Appendix II(J); 40 CFR Part 247; 42 U.S.C. § 6901, et seq (Resource Conservation and Recovery Act [RCRA])*

Contract Dollar Threshold: \$10,000

Contractor and subcontractor agree to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and the regulatory provisions of 40 CFR Part 247. In the performance of this contract and to the extent practicable, the Contractor and subcontractors are to use products containing the highest percentage of recovered materials for items designated by the Environmental Protection Agency (EPA) under 40 CFR Part 247 whenever:

- 1) The contract requires procurement of \$10,000 or more of a designated item during the fiscal year; or
- 2) The contractor has procured \$10,000 or more of a designated item using Federal funding during the previous fiscal year.

The list of EPA-designated items is available at www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products.

Section 6002(c) establishes exceptions to the preference for recovery of EPA-designated products if the contractor can demonstrate the item is:

- a) Not reasonably available within a timeframe providing for compliance with the contract performance schedule;

- b) Fails to meet reasonable contract performance requirements; or
- c) Is only available at an unreasonable price.

A19: RIGHTS TO INVENTIONS

Sources: *2 CFR Part 200, Appendix II(F); 37 CFR Part 401*

Contract Dollar Threshold: \$0

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 CFR part 401, Rights to Inventions Made by Non-profit Organizations and Small Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 CFR § 401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

A20: SEISMIC SAFETY

Source: *49 CFR Part 41*

Contract Dollar Threshold: \$0

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

A21: CERTIFICATION OF OFFEROR/BIDDER REGARDING TAX DELINQUENCY AND FELONY CONVICTIONS

Sources: *Section 8113 of the Consolidated Appropriations Act, 2022 (P.L. 117-103) and similar provisions in subsequent appropriations acts; DOT Order 4200.6 – Appropriations Act Requirements for Procurement and Non-Procurement Regarding Tax Delinquency and Felony Convictions*

Contract Dollar Threshold: \$0

The applicant must complete the following two certification statements. The applicant must indicate its current status as it relates to tax delinquency and felony conviction by inserting a checkmark (✓) in the space following the applicable response. The applicant agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification in all lower tier subcontracts.

Certifications

- 1) The applicant represents that it is () is not () a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.
- 2) The applicant represents that it is () is not () a corporation that was convicted of a criminal violation under any Federal law within the preceding 24 months.

Note

If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the Sponsor has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore must provide information to the owner about its tax liability or conviction to the Owner, who will then notify the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the required considerations before award decisions are made.

Term Definitions

Felony conviction: Felony conviction means a conviction within the preceding twenty-four (24) months of a felony criminal violation under any Federal law and includes conviction of an offense defined in a section of the U.S. Code that specifically classifies the offense as a felony and conviction of an offense that is classified as a felony under 18 U.S.C. § 3559.

Tax Delinquency: A tax delinquency is any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

A22: TERMINATION OF CONTRACT

Sources: 2 CFR Part 200 Appendix II (B); FAA Advisory Circular 150/5370-10, Section 80-09

Contract Dollar Threshold: \$10,000

Termination for Convenience

The Owner may terminate this contract in whole or in part at any time by providing written notice to the Contractor. Such action may be without cause and without prejudice to any other right or remedy of Owner. Upon receipt of a written notice of termination, except as explicitly directed by the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

1. Contractor must immediately discontinue work as specified in the written notice.
2. Terminate all subcontracts to the extent they relate to the work terminated under the notice.
3. Discontinue orders for materials and services except as directed by the written notice.
4. Deliver to the Owner all fabricated and partially fabricated parts, completed and partially completed work, supplies, equipment and materials acquired prior to termination of the work, and as directed in the written notice.
5. Complete performance of the work not terminated by the notice.
6. Take action as directed by the Owner to protect and preserve property and work related to this contract that Owner will take possession.

Owner agrees to pay Contractor for:

1. Completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination;

2. Documented expenses sustained prior to the effective date of termination in performing work and furnishing labor, materials, or equipment as required by the contract documents in connection with uncompleted work;
3. Reasonable and substantiated claims, costs, and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and
4. Reasonable and substantiated expenses to the Contractor directly attributable to Owner's termination action.

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner's termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this contract.

Termination for Cause (Construction Projects)

Section 80-09 of FAA Advisory Circular 150/5370-10 establishes standard language for conditions, rights, and remedies associated with Owner termination of this contract for cause due to default of the Contractor.

Termination for Cause (Equipment Purchases)

The Owner may, by written notice of default to the Contractor, terminate all or part of this Contract for cause if the Contractor:

1. Fails to begin the Work under the Contract within the time specified in the Notice-to-Proceed;
2. Fails to make adequate progress as to endanger performance of this Contract in accordance with its terms;
3. Fails to make delivery of the equipment within the time specified in the Contract, including any Owner approved extensions;
4. Fails to comply with material provisions of the Contract;
5. Submits certifications made under the Contract and as part of their proposal that include false or fraudulent statements; or
6. Becomes insolvent or declares bankruptcy.

If one or more of the stated events occur, the Owner will give notice in writing to the Contractor and Surety of its intent to terminate the contract for cause. At the Owner's discretion, the notice may allow the Contractor and Surety an opportunity to cure the breach or default.

If within 10 days of the receipt of notice, the Contractor or Surety fails to remedy the breach or default to the satisfaction of the Owner, the Owner has authority to acquire equipment by other procurement action. The Contractor will be liable to the Owner for any excess costs the Owner incurs for acquiring such similar equipment.

Payment for completed equipment delivered to and accepted by the Owner shall be at the Contract price. The Owner may withhold from amounts otherwise due the Contractor for such completed equipment, such sum as the Owner determines to be necessary to protect the Owner against loss because of Contractor default.

Owner will not terminate the Contractor's right to proceed with the work under this clause if the delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such acceptable causes include acts of God, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, and severe weather events that substantially exceed normal conditions for the location.

If, after termination of the Contractor's right to proceed, the Owner determines that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the Owner issued the termination for the convenience the Owner.

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

A23: FOREIGN TRADE RESTRICTION CERTIFICATION

Sources: *49 U.S.C. §50104; 49 CFR Part 30*

Contract Dollar Threshold: \$0

By submission of an offer, the Offeror certifies that with respect to this solicitation and any resultant contract, the Offeror –

- 1) is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (USTR);
- 2) has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country included on the list of countries that discriminate against U.S. firms as published by the USTR; and
- 3) has not entered into any subcontract for any product to be used on the Federal project that is produced in a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18 U.S.C. § 1001.

The Offeror/Contractor must provide immediate written notice to the Owner if the Offeror/Contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Contractor must require subcontractors provide immediate written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR § 30.17, no contract shall be awarded to an Offeror or subcontractor:

- 1) who is owned or controlled by one or more citizens or nationals of a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR; or
- 2) whose subcontractors are owned or controlled by one or more citizens or nationals of a foreign country on such USTR list; or
- 3) who incorporates in the public works project any product of a foreign country on such USTR list.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

The Offeror agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in all lower tier subcontracts. The Contractor may rely on the certification of a prospective subcontractor that it is not a firm from a foreign country included on the

list of countries that discriminate against U.S. firms as published by USTR, unless the Offeror has knowledge that the certification is erroneous.

This certification is a material representation of fact upon which reliance was placed when making an award. If it is later determined that the Contractor or subcontractor knowingly rendered an erroneous certification, the Federal Aviation Administration (FAA) may direct through the Owner cancellation of the contract or subcontract for default at no cost to the Owner or the FAA.

A24: VETERAN'S PREFERENCE

Source: *49 U.S.C. § 47112(c)*

Contract Dollar Threshold: \$0

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within 49 U.S.C. § 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 U.S.C. § 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

A25: CERTIFICATION REGARDING DOMESTIC PREFERENCES FOR PROCUREMENTS

Sources: *2 CFR § 200.322; 2 CFR Part 200, Appendix II(L)*

Contract Dollar Threshold: \$0

The Bidder or Offeror certifies by signing and submitting this bid or proposal that, to the greatest extent practicable, the Bidder or Offeror has provided a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including, but not limited to, iron, aluminum, steel, cement, and other manufactured products) in compliance with 2 CFR § 200.322.

A26: PROHIBITION OF COVERED UNMANNED AIRCRAFT SYSTEMS (UAS)

Source: *FAA Reauthorization Act of 2024 (P.L. 118-63), Section 936; 49 U.S.C. § 44801 note*

Contract Dollar Threshold: \$0

The Bidder or Offeror certifies that they are aware of and comply with relevant Federal statutes and regulations, including those from the Federal Aviation Administration (FAA), for operating unmanned aircraft systems (UAS) in accordance, and in compliance with all related requirements in the FAA Reauthorization Act of 2024 (P.L. 118-63), section 936 (49 U.S.C. § 44801 note).

Contractor warrants that all UAS operations will be conducted in full compliance with all applicable Federal Aviation Administration (FAA) regulations, including but not limited to 14 CFR Part 107, and any other applicable local, state, or Federal laws and regulations.

Sponsors and subgrant recipients cannot use AIP grant funds to enter into, extend, or renew a contract related to covered unmanned aircraft systems (UAS). This includes both procurement and operational contracts, as well as contracts with entities that operate such systems.

END OF FEDERAL CONTRACT PROVISIONS FOR FAA FUNDED PROJECTS

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Davis-Bacon Wage Rates

for

Rehabilitate Runway 6-24

at

Roanoke-Blacksburg Airport

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State: Virginia

Construction Types: Highway

Counties: Virginia Counties of
Roanoke, Salem* and Roanoke*

* Designates Independent City

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ELEC0080-011 06/01/2025

	Rates	Fringes
ELECTRICIAN, INCLUDES TRAFFIC SIGNALIZATION.....	\$ 36.85	14.13

SUVA2016-073 07/02/2018

	Rates	Fringes
TRUCK DRIVER: MULTI AXLE.....	\$ 17.53	0.00
TRUCK DRIVER: HEAVY OVER 7 CY.....	\$ 16.60	0.00
TRUCK DRIVER: FUEL AND LUBRICANT SERVICE.....	\$ 18.25	0.00
TRUCK DRIVER: 1/SINGLE AXLE TRUCK.....	\$ 15.95	0.00
TRUCK DRIVER : HEAVY 7CY & UNDER.....	\$ 15.36	0.00
TRAFFIC CONTROL: FLAGGER.....	\$ 11.84	0.00
OPERATOR: BULLDOZER, INCLUDING UTILITY.....	\$ 17.81	0.00
OPERATOR: ASPHALT SPREADER AND DISTRIBUTOR.....	\$ 16.44	0.00
OPERATOR: SCREED.....	\$ 22.13	4.89
OPERATOR: ROLLER (FINISHING).....	\$ 14.31	0.00
OPERATOR: ROLLER.....	\$ 14.81	0.00
OPERATOR: PILEDRIVER.....	\$ 21.83	4.08
OPERATOR: PAVER (ASPHALT, AGGREGATE, AND CONCRETE).....	\$ 16.85	0.00
OPERATOR: PAVEMENT PLANER.....	\$ 17.01	0.00
OPERATOR: MILLING MACHINE.....	\$ 23.12	3.60
OPERATOR: MECHANIC.....	\$ 20.00	0.00
OPERATOR: LOADER.....	\$ 15.86	0.00
OPERATOR: HYDROSEEDER.....	\$ 16.64	0.00
OPERATOR: GRADER/BLADE.....	\$ 26.13	0.00
OPERATOR: GRADALL.....	\$ 18.65	0.00
OPERATOR: DRILL.....	\$ 24.66	0.00
OPERATOR: CRANE.....	\$ 25.82	0.00
OPERATOR: BROOM/SWEEPER.....	\$ 14.32	0.25
OPERATOR: BOBCAT/SKID STEER/SKID LOADER.....	\$ 19.16	4.45
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE.....	\$ 17.29	0.34
LABORER: POWER TOOL OPERATOR.....	\$ 15.69	0.00
LABORER: PIPELAYER.....	\$ 13.14	0.00
LABORER: GRADE CHECKER.....	\$ 15.07	0.00
LABORER: COMMON OR GENERAL.....	\$ 14.34	0.00
LABORER: ASPHALT, INCLUDES RAKER, SHOVELER, SPREADER AND DISTRIBUTOR.....	\$ 15.40	0.00
IRONWORKER, STRUCTURAL.....	\$ 27.38	0.00
IRONWORKER, REINFORCING.....	\$ 22.71	0.00

CEMENT MASON/CONCRETE FINISHER.....	\$ 19.94	0.00
CARPENTER, INCLUDES FORM WORK.....	\$ 17.65	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than **US**, **UAVG**, **SA**, or **SC** denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next

number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE:

UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The SU identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

SU wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The SA identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the SA identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can

be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

SECTION F - Other Contract Forms

for

Rehabilitate Runway 6-24

at

Roanoke-Blacksburg Airport

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Warranty of Construction

Project: Rehabilitate Runway 6-24
Airport Name: Roanoke-Blacksburg Airport
Airport Location: Roanoke, Virginia
Grant No(s): Pending
Date of Final Acceptance: _____

_____, (Contractor), located at _____, hereby guarantees that all labor and material furnished and Work performed under the Contract for the above-named Project are in accordance with the Contract Documents and authorized alterations and additions thereto, and that all of the Work under the Contract is free from faulty materials and improper workmanship, and guaranteed against injury from proper and usual wear, and agreeing (and we do hereby so agree) that should any defect develop during the Contract guarantee period, as hereinafter defined, due to improper materials, workmanship or arrangement, we will, upon written notice, replace or re-execute such defective work, together with any other Work affected in making good such defects, at the convenience of, and without expense to the Owner.

The Contractor further warrants that all manufacturer's or other warranties on all materials and equipment furnished by Contractor shall run directly to or be specifically assigned to Owner on demand. The Contractor warrants that the installation of any and all materials and equipment shall be in strict accordance with manufacturer's requirements. In the event Owner seeks to enforce a claim based upon a manufacturer's warranty and should such manufacturer then fail to honor its warranty based, in whole or in part, on a claim of defective installation, Owner shall be entitled to enforce said warranty against Contractor in accordance with the terms of said warranty, except that a claim of defective installation shall not be a defense to any such warranty claim by Owner against Contractor.

The Contract guarantee period shall be a period of one (1) year from final acceptance, as noted above, except in the cases of LED light fixtures, manufacturer's or other required extended warranties that extend for periods greater than one year from final acceptance, whereby the Contract guarantee period shall extend to match for the items that are so warranted. All LED light fixtures with the exception of obstruction lighting (AC 150/5345-43) must be warranted for a minimum of four (4) years after date of installation inclusive of all electronics.

The warranty for any work repaired or replaced during the guarantee period shall run for a period of one (1) year from the date of repair or replacement.

[SIGNATURES FOLLOW ON THE NEXT PAGE]

Contractor's Name (print)

Contractor's Signature

Subscribed and sworn before me in the Commonwealth of Virginia, this _____ day of _____, 20____.

Notary Public

My Commission Expires

Lien and Claims Release

Project: Rehabilitate Runway 6-24
Airport Name: Roanoke-Blacksburg Airport
Airport Location: Roanoke, Virginia
Grant No.: Pending

_____(Contractor), located at _____,
hereby certifies that the Work performed under the Contract for the above-named Project has been completed in accordance with the Contract Documents and authorized alterations and additions thereto, and that all previous progress payments received from the Owner on account of Work performed under the Contract have been applied by the undersigned to discharge in full all obligations of the undersigned incurred in connection with the Work covered by prior requisitions for payment under said Contract and that all materials and equipment covered by the final requisition for payment are free and clear of all liens, claims, security interests and encumbrances. All persons, firms and partnerships who have furnished labor and/or material to date on said Project have been paid.

Contractor's Name (*print*)

Contractor's Signature

Subscribed and sworn before me in the Commonwealth of Virginia, this _____ day of _____, 20____.

Notary Public

My Commission Expires

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Certificate of Substantial Completion

Project: Rehabilitate Runway 6-24
Airport Name: Roanoke-Blacksburg Airport
Airport Location: Roanoke, Virginia
Grant No(s).: Pending
Contract Date: _____

This Certificate of Substantial Completion applies to all Work performed under the Contract Documents and authorized alterations and additions thereto for the above-named Project completed by _____ (Contractor) for the Roanoke Regional Airport Commission (Owner).

The Work to which this Certificate applies has been observed by authorized representatives of the Owner, Contractor, and Engineer, and that the Work is hereby declared to be substantially complete in accordance with the Contract Documents as of _____.

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of Contractor to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by the Contractor within thirty (30) calendar days of the above Date of Substantial Completion.

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

ENGINEER: Delta Airport Consultants, Inc. _____

Name: *(print)* _____

Signature: _____ Date: _____

CONTRACTOR: _____

Name: *(print)* _____

Signature: _____ Date: _____

OWNER: Roanoke Regional Airport Commission _____

Name: *(print)* _____

Signature: _____ Date: _____

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Certificate of Final Acceptance

Project: Rehabilitate Runway 6-24
Airport Name: Roanoke-Blacksburg Airport
Airport Location: Roanoke, Virginia
Grant No(s).: Pending
Contract Date: _____

This Certificate of Final Acceptance applies to all Work performed under the Contract Documents and authorized alterations and additions thereto for the above-named Project completed by _____ (Contractor) for the Roanoke Regional Airport Commission (Owner).

The Work to which this Certificate applies has been observed by authorized representatives of the Owner, Contractor, and Engineer, and that Work is hereby accepted as complete on _____.

The following documents and information are attached to and made a part of this Certificate:

- (1) Warranty of Construction
- (2) Lien and Claims Release

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

ENGINEER: Delta Airport Consultants, Inc. _____

Name: *(print)* _____

Signature: _____ Date: _____

CONTRACTOR: _____

Name: *(print)* _____

Signature: _____ Date: _____

OWNER: Roanoke Regional Airport Commission _____

Name: *(print)* _____

Signature: _____ Date: _____

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SECTION G - Special Provisions and Technical Specifications

for

Rehabilitate Runway 6-24

at

Roanoke-Blacksburg Airport

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Special Provisions

01.SP Additional Insured Requirements

The Contractor shall specify the Owner and the Engineer as named additional insured in all insurance required under the provisions of Section 70-21 Insurance Requirements. The Contractor shall provide an allowance for the cost, if any, of providing this additional insurance. Upon receipt documenting the actual amount and proof of payment, the Contractor can submit for the actual cost under Special Provision Item "Non-AIP Insurance" up to the allowance amount. Any additional cost above the allowance shall be at the Contractor's expense. The cost indicated for this item, if any, shall not be a factor when determining the award of bid.

02.SP Conflict with Other Controls

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

03.SP Pavement Loading

The existing airport pavements are designed for aircraft on single and dual gear configurations. The Contractor shall preserve and/or protect existing and new pavements from damage due to construction operations. Existing pavements which are damaged shall be replaced or repaved at the Contractor's expense. The Contractor shall take immediate action to alleviate the problem.

04.SP Communications

The Contractor shall keep the Engineer and/or Resident Project Representative apprised of his/her scheduled construction activities in order to allow proper notification of the airport manager and airport operators. As a minimum, weekly meetings to discuss construction progress and location should be anticipated.

The Contractor shall have a two-way radio at the jobsite at all times work is in progress. The Contractor shall monitor the ground control or tower frequency.

05.SP Aircraft Operations

It is the intent of the Owner to minimize interference with aircraft operations. The Contractor shall coordinate his/her activities while working near the aircraft operational area, so as to create minimal interference with aircraft operations. Before starting his/her operations at any location on the airport, the Contractor shall assure proper safety precautions and separations are in place in accordance with the Plans, Construction Safety Phasing Plan (CSPP) and the contractor's Safety Plan Compliance Document (SPCD), all prepared in accordance with FAA Advisory Circular (AC) 150/5370-2G, *Operational Safety on Airports During Construction*.

06.SP Shop Drawings and Samples

The Contractor shall review and approve all shop drawings and submittals for conformance to the contract documents before submittal to the Engineer. After reviewing the plans and specifications and/or verifying all field measurements, the Contractor shall submit to the Engineer for review and approval copies of all shop drawings, certificates, and samples. These drawings shall bear a stamp or specific written indication that the Contractor has satisfied the Contractor's responsibilities under the Contract

Documents with respect to the review of the submission. The Contractor shall certify the following by placing a stamp or specific written indication on the shop drawings.

“This shop drawing has been reviewed by NAME OF CONTRACTOR and approved with respect to the means, methods, techniques, sequences, procedures of construction, safety precautions and programs incidental thereto. NAME OF CONTRACTOR also warrants that this shop drawing complies with the contract documents and comprises no variations thereto, unless noted below.”

“NAME OF CONTRACTOR certifies that this shop drawing complies with Buy American requirements as established under 49 USC Section 50101. Steel products must be 100% U.S. domestic product Manufactured Products. Preference shall be given to products that are 100% manufactured and assembled in the U.S. Manufactured products not meeting the 100% U.S. domestic preference may only be used on the project if the FAA has officially granted a permissible waiver to Buy American Preferences.”

All submissions shall be identified as the Engineer may require. The data shown on the shop drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable the Engineer to review the information.

The Contractor shall also submit to the Engineer for review and approval with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples will have been checked by and accompanied by a specific written indication that the Contractor has satisfied the Contractor's responsibilities under the Contract Documents with respect to the review of the submission and shall be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.

Before submission of each shop drawing or sample, the Contractor shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each shop drawing or sample with other shop drawings and samples and with the requirements of the work and the Contract Documents.

At the time of each submission, the Contractor shall give the Engineer specific written notice of each variation that the shop drawings or samples may have from the requirements of the Contract Documents, and, in addition, shall cause a specific notation to be made on each shop drawing submitted to the Engineer for review and approval of each such variation.

For each shop drawing or sample submittal, the Contractor shall utilize a cover sheet similar in format and content to the “Sample Submittal Form” attached as an appendix to these specifications.

The Engineer will review with reasonable promptness, shop drawings and samples, but the Engineer's review will be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, techniques, sequences or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. The Contractor shall make corrections required by the Engineer and shall return the required number of corrected copies of shop drawings and submit as required new samples for review and approval. The Contractor shall direct specific attention, in writing, to revisions other than the corrections called for by the Engineer on previous submittals.

The Engineer's review of the shop drawings or samples shall not relieve the Contractor from responsibility for any variation from the requirements of the Contract Documents unless the Contractor has, in writing, called the Engineer's attention to each such variation at the time of submission and the Engineer has given written concurrence of each such variation by a specific written notation thereof, incorporated in, or accompanying the shop drawings or sample approval; nor will any review by the Engineer relieve the Contractor from responsibility for errors or omissions in the shop drawings.

Where a shop drawing or sample is required by the Specifications, any related work performed prior to the Engineer's review of the pertinent submission will be the sole expense and responsibility of the Contractor.

The Contractor shall submit shop drawings electronically, via the Engineers Newforma/Info Exchange site. Contractor shall submit electronic versions of each individual submittal to the Engineer in a printable PDF format. Submittals that are larger than 11x17 shall be submitted with one hard copy in addition to the electronic version. Formatting of the PDF drawings shall be of the same size as the hard copy submittal.

The Contractor will be provided access to the Engineer's secured project hosting site (Newforma) via a personalized password protected account. This site utilizes a web browser interface that requires internet access, and an individual email account. The Engineer will provide the Contractor with submittal protocol and process documentation for the hosting site when the account information is verified and configured by the Engineer.

The Engineer will return submittals electronically in PDF format.

07.SP Contractor's Application for Payment Form

The Contractor shall provide a Contractor's Application for Payment Form to submit for payment. At a minimum, the form shall include the following:

- Name of Project
- Name and address of Owner
- Name and address of Contractor
- Application number and date
- Applicable Project Numbers (Owner, Engineer, Contractor, etc.)
- Original contract amount
- Sum of approved change orders
- Total value of work completed to date
- Total value of materials stored on hand in accordance with Section 90-07 of the Specifications
- Amount retained in accordance with Section 90-06 of the Specifications
- Total amount earned to date
- Total amount received to date
- Amount currently due
- Balance to finish
- Contractor's Certification
- Line item for each bid item from the Bid Proposal with the following included:
 - Item No.
 - Specification No.
 - Description
 - Unit
 - Unit Price
 - Contract Quantity
 - Quantity this Request
 - Quantity to Date
 - Amount this Request

- Amount to Date
- Signature blocks for the Contractor, Resident Project Representative (as applicable), and Engineer

The Contractor shall submit a draft Contractor's Pay Application Form prior to the Preconstruction Conference for review and approval prior to use. The cost for providing the Contractor's Pay Application Form shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Contractor's Application for Payment Form

08.SP Record Drawings

The Contractor shall maintain during the work and shall provide the Engineer with one set of marked prints showing any modifications between the original plans and final "as-constructed" conditions. The Contractor shall provide the marked set of drawings to the Engineer at the final inspection. The cost for providing the record drawings shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Plan set with red-line as-built markups and surveys

09.SP Final Inspections

The Engineer will attend a final inspection and if necessary, one follow-up final inspection of the completed work and the completed punch list items, respectively. These inspections will be scheduled when the Contractor indicates that the work is complete and ready for final inspection or that the punch list is totally complete, and the final inspection can be made. If the Engineer is required to conduct more than two (2) final inspections outlined above, the charges for the Engineer's services associated with such additional inspections shall be deducted by the Owner from the Contractor's final payment for the project.

10.SP Existing Airfield Features

The Contractor shall protect existing items on the airfield that are not identified to be removed or modified. This may include pavements, markings, lighting fixtures, signs, survey monuments, etc. An inventory of conditions of the project and all items that are to remain shall be taken before construction begins and the Contractor shall be responsible for the cost of replacement of any fixtures damaged by his/her operations. The cost for providing the existing airfield features inventory list shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Existing Features Inventory List

11.SP Project Schedule

The Contractor shall submit a detailed progress schedule for the entire project at least 10 days prior to the Preconstruction Conference. The schedule shall be developed in a "Critical Path Method" (CPM) format to include production rates per work period and time for mobilization and demobilization. Once the Contractor's schedule has been reviewed by the Engineer, any deviations must be incorporated into an updated schedule and submitted for review by the Engineer. The initial schedule will be used as a baseline for determining impacts to the critical path items of the schedule due to weather or other items as may be documented by the contractor that is potentially a reason to extend the contract time period.

The Contractor shall review the project schedule with the Engineer and/or Resident Project Representative (RPR) prior to submittal of the monthly Contractor Pay Request. Any update deemed necessary by the Engineer, RPR or Contractor shall be incorporated into an updated schedule. The updated schedule shall be submitted with the pay request. The Pay Request will not be processed unless an accurate up-to-date schedule is on file with the Engineer. The cost for providing and maintaining the project schedule shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Project Schedule

12.SP Construction Flags and Amber Lights

During work in the Air Operation Area (AOA), the Contractor shall furnish amber flashing hazard beacons or aircraft warning flags on all vehicles and equipment in accordance with Advisory Circular (AC) 150/5210-5D, *Painting, Marking, and Lighting of Vehicles Used on an Airport*. Amber flashing hazard beacons or aircraft warning flags may be used during the day. Amber flashing hazard beacons are required for nighttime operations.

The beacons shall be mounted on the uppermost part of the vehicle structure or equipment so that it will be visible from any direction, day and night, including from the air.

The flags shall be at least a 3-foot square having a checkered pattern of international orange and white squares at least 1 foot on each side in accordance with AC 150/5210-5D. Flags on equipment shall be mounted on a staff not less than 8 feet in length.

13.SP Alternates

The alternates developed under this project have been designed for budget flexibility. Each lower numbered alternate includes the work of higher numbered alternates. The bid proposal quantities for each alternate are independent, i.e., only one alternate will be awarded if the Owner elects to make an award. The Owner reserves the right to award the alternate which is in the best interest of the Owner.

14.SP Employment History

The Contractor shall provide background information concerning the ten (10) year employment history on all its employees or affiliated personnel who will be involved with work inside the security fence. Based upon background information on an employee, the Owner reserves the right to restrict the access of an employee of the Contractor from working inside the security fence for reasons of airport security. Identification badges will be required for all personnel entering the aircraft operational areas (AOA) and can be obtained from the Airport Manager. A nominal fee may be charged to cover the cost of the materials for these identification badges. The cost for providing and maintaining the employment history shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Employment History

15.SP Utility Conflicts

The Contractor should anticipate conflicts with existing utilities. Where conflicts are encountered, the Contractor shall reroute electrical conduits, ducts, water pressure lines and/or force mains around gravity lines which will take precedence over pressure lines for maintaining vertical alignment as shown on plans. Conflicts between pressure lines shall be resolved as ordered by the Engineer. No additional payment will be made for rerouting utilities due to conflicts.

The Contractor shall be responsible for repair to utilities in service which are damaged by the Contractor's men and equipment. The Contractor shall assume all risk and liability for any inconvenience, delay, or expense that may be occasioned by public utilities. No additional compensation will be allowed for delays, inconvenience, or damage sustained by the Contractor due to interference from the said utility appurtenances or the operations of moving them. The time for completion may be extended if it is determined by the owner that a project delay to critical path work items has occurred.

16.SP Testing General

The Contractor shall inform the Engineer when work in progress or an area will be subject to or has been prepared for testing. Timely communication between the Contractor and the Engineer will be required to schedule needed testing. All quality assurance testing will be performed by the Owner's testing laboratory under the direction of the Engineer. The Contractor is advised that the cost of failing tests requiring additional tests to confirm compliance will be deducted from the monies due to the Contractor through the

Progress Payment Process. For materials requiring test strips (P-401, P-403, etc.), this shall include costs incurred after two (2) failing test strips. The testing laboratory shall not be used by the Contractor for quality control purposes. The Contractor shall provide quality control testing in accordance with Item C-100.

17.SP Materials Testing

The Contractor shall provide actual test results and/or certifications for all materials incorporated into the work to assure his/her compliance with the contract specifications. Current ASTM, AASHTO, and/or federal specifications on the date of advertisement for bids shall be used. The latest edition of other referenced specifications, handbooks or documents shall be used. Prior to installing, placing, or incorporating any materials into the work, the Contractor shall provide four (4) copies of the materials tests and/or certifications required by the specifications to the Engineer.

The Testing/Certification submittals required by the specifications shall be provided by the Contractor to the Engineer at the Contractor's expense. The required submittals shall be all tests and certifications required by the specifications.

18.SP Dust Control

The Contractor is advised that aircraft maintenance operations are conducted adjacent to the project. Special attention to dust control will be required during the course of the project. The use of water and calcium chloride shall be anticipated. The Engineer reserves the right to halt work or hauling in non-conforming areas if corrective actions are not promptly taken by the Contractor to control dust.

19.SP Storm Water Pollution Prevention Plan

The Contractor shall be responsible for developing and executing a Storm Water Pollution Prevention Plan (SWPPP) in accordance with location and state regulations. A copy of the SWPPP shall be submitted to the Engineer for approval and one (1) copy of the approved and executed plan shall be kept on-site at all times. The cost of completing the SWPPP and implementing its practices shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Storm Water Pollution Prevention Plan (SWPPP)

20.SP On-Site Contractor Supervision

The Contractor shall keep on the project at all times during its progress, a competent resident superintendent whose name and qualifications shall be furnished to the Engineer at the Pre-Construction Meeting and who shall not be replaced without prior written notice to the Engineer, except under extraordinary circumstances, in which event immediate written notice shall be given to the Engineer. The superintendent will be the Contractor's representative at the site and shall have the authority to act on behalf of the Contractor and to receive any and all notices or instructions given pursuant to the Contract Documents. The superintendent shall be an employee of the Contractor. The Contractor shall provide competent and suitable personnel, equipment and supplies to perform the work required by the Contract Documents. He/she shall at all times maintain good discipline and order at the site. The cost for providing the superintendent qualifications shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Superintendent Qualifications

21.SP Storage / Staging Area

All construction material storage, equipment, and vehicle parking will be designated by the Owner. Under no circumstances shall material, equipment, and/or vehicles be stored in such a place as to create an obstruction to vehicular traffic. All storage shall be limited to the designated area(s) on the project site; no storage of any equipment or material shall be allowed at any place other than the project site unless otherwise approved by the Owner. Climate conditioning for stored materials shall be the responsibility of the Contractor.

22.SP Security

The Contractor shall be responsible for the security of his/her equipment and materials, as well as the security of the equipment and materials of the Contractor's agents and Subcontractors. Further, the Contractor shall be responsible for the security of all entrances to the project site.

The Contractor shall exercise and take all precautions in the storage and dispensing of all flammable liquids such as, but not limited to, gasoline, fuel, and lubricants.

The Contractor shall be responsible for the direct supervision of his/her employees, those of his/her agents and Subcontractors at all times while on the project site.

The Contractor shall provide the Owner or its designated representative a list of all his/her employees as well as a list of all the employees of his/her Subcontractors and shall, during the work of the project, advise such designated agent of changes to the list of personnel working on the project. The cost for preparing and providing a list of all Contractor and subcontractor employees shall be considered incidental to the cost of the project.

Required Contractor Deliverable: List of Contractor and Subcontractor Employees

23.SP Motorized Vehicles

The Contractor shall be responsible for the actions of his/her employees, agents, and Subcontractors. Personnel who do not abide by the applicable rules and regulations shall be subject to prosecution.

All motorized vehicles and equipment operating on the project site and anywhere else on the Airport shall not exceed a speed of 15 mph, and all aircraft shall have priority over all motorized vehicles and equipment.

24.SP Debris

Waste and loose material shall be removed immediately and continuously during the construction work of the project. The removal and disposal of all debris shall be the responsibility of the Contractor. All debris shall be disposed of off the project site and the Airport property in conformance with prevailing local ordinances, codes, and Federal laws.

25.SP Contractor's Contact Persons

The Contractor shall provide the name and mobile phone number of at least two (2) people to be contacted in case of emergencies at the work site during non-working hours. The contact people must be qualified and have the authority to make decisions on behalf of the Contractor. There must be at least one (1) contact person on-call and available to be at the site within one (1) hour. This item is to be considered incidental to the project and no additional or separate payment will be made.

The Contractor shall provide the name of the Project Manager. This person will be the Contractor's representative to whom the Engineer and Owner shall address all relevant correspondence or communications. The Contractor shall not change the Project Manager without approval of the Engineer and/or Owner. The names of the Project Manager and the two (2) Emergency Contact Persons shall be provided at the Preconstruction Conference.

The cost for providing and maintaining the emergency contact list shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Emergency Contact List

26.SP Safety Plan Compliance Document (SPCD)

Introduction:

The Contractor is responsible for compliance with FAA Advisory Circular (AC) 150/5370-2G, *Operational Safety on Airports During Construction* and the project Construction Safety and Phasing

Plan (CSPP) and is responsible for preparing a project specific Safety Plan Compliance Document (SPCD) describing their plan for said compliance.

Definitions and References:

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

This FAA Advisory Circular document outlines the responsibilities and requirements for CSPPs and SPCDs, as well as operational safety requirements.

CSPP – Construction Safety & Phasing Plan

This Owner document is prepared in accordance with AC 150/5370-2G and outlines the project specific requirements for airfield operational safety, work area milestones, and sequencing during construction of the project. It is a project specific document that is prepared by the Owner. A copy is attached as an appendix to these specifications.

SPCD – Safety Plan Compliance Document

This Contractor document is prepared in accordance with AC 150/5370-2G and outlines the specific methods and actions to be taken by the Contractor to ensure compliance with the CSPP. The Contractor is responsible for developing a project specific SPCD and submitting it to the Owner for review prior to the start of construction. The document shall include the items listed in AC 150/5370-2G, Chapter 2.4.2.

Summary:

The Contractor is responsible for complying with AC 150/5370-2G, the Owner prepared CSPP, and the Contractor prepared SPCD.

In accordance with the contract documents, jobsite safety is the sole responsibility of the Contractor. The Engineer is not responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto. In reviewing any documents prepared by the Contractor, neither the Owner nor Engineer assumes any responsibility for jobsite safety.

The cost for providing and maintaining the SPCD, and compliance with the three noted documents, shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Safety Plan Compliance Document (SPCD)

27.SP Engineer's Field Office

The Contractor shall furnish, erect, and maintain a building for use as the Engineer's field office for the duration of the project. In addition to the requirements outlined in Section 60-05, the building shall be tightly floored and roofed, constructed with an air space above the ceiling for ventilation, and supported above the ground. The width of the office shall not be less than 8 feet and the floor-to-ceiling height shall not be less than 7 feet 6 inches, unless a trailer is provided in which event the width shall not be less than 7 feet 6 inches and the floor-to-ceiling height shall not be less than 6 feet 6 inches. The building shall have a meeting space with a minimum of 240 square feet. The inside walls and ceiling shall be constructed of plywood, masonite, gypsum board or other suitable materials. Walls and ceiling shall be insulated.

The office shall contain at least 3 windows, each having an area of not less than 540 square inches, and all of which shall be capable of being easily opened and secured from the inside only. Further, the office shall contain at least two (2) doors, having dimensions of not less than 30 inches in width and 78 inches in height. Window screens shall be provided. The door(s) shall be equipped with lock(s) and at least 2 keys therefore shall be furnished to the Engineer or Resident Project Representative. Steps shall conform to the State Building Code and shall be maintained free of obstructions to provide safe passage.

The office shall include the following furniture and equipment:

- Desk (60 inches by 34 inches minimum)
- Plan and Drawing Table (30 inches by 96 inches minimum)

- Metal 4-Drawer File Cabinet (15-inch Drawer Width)
- Desk Chair
- Wastebasket (2 minimum)
- Printer/Copier/Scanner
- Conference Table (84 inches by 35 inches minimum) with Chairs (8 minimum)

The office shall have satisfactory lighting, water, heating equipment, exhaust fan, air-conditioner and electrical outlets connected to an operational power source. At least one of the light fixtures shall be a fluorescent light situated over the plan and drawing table.

Fuel for the heating equipment and electrical current shall be furnished by the Contractor. The Contractor shall also furnish and maintain one chemical type and one 2 1/2-gallon pressurized water fire extinguisher of standard commercial quality.

The Contractor shall install a toilet facility for the Field Office, which may be either indoor or outdoor. When separate facilities for men and women are not available, a sign with the wording, "Restroom" (letter heights of 1-inch minimum) shall be placed over the doorway and an adequate positive locking system shall be provided on the inside of the doorway to insure privacy. The Contractor shall maintain the toilet facility in a clean and sanitary condition. As a minimum, weekly service and cleaning shall be provided.

All requirements of the State and Local Boards of Health, or of other bodies or courts having jurisdiction in the area, shall be provided. An adequate positive locking system shall be provided on the inside of the doorway to insure privacy.

The Contractor shall provide a chilled drinking water dispenser and water supply in the field office. Bottled water is satisfactory.

The Contractor shall provide and maintain a stand-alone, mobile hotspot device to provide Wifi access to the Internet via a cellular network for the exclusive use of the Resident Project Representative (RPR). The network selected by the Contractor shall provide 5G service or a minimum of 4G service in areas where 5G service is unavailable. Wifi service at the project site shall have a good (3-bars) signal or better unless otherwise approved in writing by the Engineer. Device shall be a Verizon Inseego MiFi X PRO 5G UW, AT&T Netgear Nighthawk M6 Pro, T-Mobile JEXTREAM RG2100 5G or approved equal, and shall be provided with an unlimited data plan. Device and data plan shall be active at the start of the project and shall remain active for the duration of the project through Final Inspection and completion of all punch list items by the Contractor. Device and data plans shall remain in the Contractor's name and will be returned to the Contractor when an RPR is no longer required on the project. The cost for providing the mobile hotspot shall be considered incidental to the mobilization for the project.

28.SP Asphalt Testing Facilities

The Contractor shall ensure laboratory facilities are provided at the plant for the use of the Engineer. The lab shall have sufficient space and equipment so that both testing representatives (Engineer's and Contractor's) can operate efficiently. The lab shall meet the requirements of ASTM D3666 including all necessary equipment, materials, calibrations, current reference standards to comply with the specifications, and a masonry saw with diamond blade for trimming pavement cores and samples.

The plant testing laboratory shall have a floor space area of not less than 200 square feet, with a ceiling height of not less than 7-1/2 feet. The laboratory shall be weather tight, sufficiently heated in cold weather, air-conditioned in hot weather to maintain temperatures for testing purposes of 70°F ±5°F. The plant testing laboratory shall be located on the plant site to provide an unobstructed view, from one of its windows, of the trucks being loaded with the plant mix materials. In addition, the facility shall include the minimum:

1. Adequate artificial lighting.

2. Electrical outlets sufficient in number and capacity for operating the required testing equipment and drying samples.
3. A minimum of two (2) Underwriter's Laboratories approved fire extinguishers of the appropriate types and class.
4. Work benches for testing.
5. Desk with chairs and file cabinet.
6. Sanitary facilities convenient to testing laboratory.
7. Exhaust fan to outside air.
8. Sink with running water.

Failure to provide the specified facilities shall be sufficient cause for disapproving HMA plant operations. Laboratory facilities shall be kept clean, and all equipment shall be maintained in proper working condition. The Engineer shall be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

29.SP Subgrade Drainage

Subgrades and construction areas are highly susceptible to damage from intrusion of surface water. Surface water should not be allowed to collect in or on prepared subgrades during or after construction. The Contractor shall be responsible for protection of the subgrade from standing water by constructing drainage ditches or by grading the site to sheet flow towards natural or artificial drainage features. Excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface water. Subgrades should be crowned or sloped to prevent collection of water and a means of escape provided for runoff. Subgrades shall be sealed with a smooth-drum roller, or covered with a mud-mat of lean concrete or other easily removable materials if the possibility of precipitation arises. Positive site drainage should be provided throughout the construction area to reduce infiltration of surface water around the perimeter of the site.

Subgrade repairs or undercut resulting from the Contractor's failure to provide positive site drainage shall be the responsibility of the Contractor and shall be completed as ordered by the Engineer at no cost to the Owner.

30.SP De-Watering During Construction

The Contractor shall provide de-watering during construction. All impounded water required to be pumped shall be pumped to the nearest acceptable receiving inlet or ditch and not allowed to discharge across pavement. Sediment shall be filtered as necessary to meet local requirements. All de-watering costs shall be considered incidental to the project. Saturated subgrade or subbase materials shall be recompacted as required by the specifications prior to placing subsequent pavement layers.

31.SP Cost Breakdown – Lump Sum Items

A breakdown of all lump sum bid item costs shall be submitted to the Owner and Engineer for review a minimum of 10 days prior to the Preconstruction Meeting. Unless otherwise noted in the specifications, the cost breakdown schedule (Schedule of Values) will be the basis for determining the value of the monthly progress payment as applicable. The total value of all construction activities shall equal the total lump sum bid amount for that bid item. The cost for providing the lump sum bid item cost breakdowns shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Lump Sum Bid Item Cost Breakdowns

32.SP Contract Time

Refer to the General Conditions.

33.SP Liquidated Damages

Refer to the General Conditions.

34.SP Submittals Schedule

The Contractor shall submit a detailed listing of all submittals and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include:

- Specification item number
- Item description
- Description of submittal
- Specification paragraph requiring submittal
- Scheduled date of submittal

The cost for providing and maintaining the submittal schedule shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Submittals Schedule

35.SP Documentation

The Contractor shall maintain daily records of all work, inspections, and tests performed. These records shall include a summary of the work performed and factual evidence that the required inspections or tests (as applicable) have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviation, causes for rejection, etc.; proposed remedial action; and corrective action.

These records must cover both conforming and defective or deficient features and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Engineer daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the Contractor's Project Superintendent. The cost for providing the noted documentation shall be considered incidental to the cost of the project.

Required Contractor Deliverable: Records of daily reports, inspections, tests, etc.

36.SP Bidders Notice

Bidders are hereby notified and agree by submission of their bid that should, after award of the contract, additional items not listed in the bid become necessary and require unit prices not established by their bid, that the unit prices of such items shall be negotiated and shall be directly proportional to the established unit prices of similar bid items.

37.SP Wage Rate Determination

These specifications include U.S. Department of Labor wage determinations per Davis-Bacon Act requirements. When multiple wage determinations are included, the Contractor shall comply with the requirements of all wage determinations and pay the higher of the wage rates.

38.SP FAA Specifications

All FAA specifications are denoted with the AC reference and date of revision at the beginning of each specification section. Edits by way of additions to the FAA standard text are denoted in all capital letters (EXAMPLE).

39.SP Contractor's Responsibility for Utility Service and Facilities of Others

The following statements concerning FAA cables and FAA NAVAID equipment shall apply to this project.

1. The local FAA Airway Facilities Sector Field Office (AFSFO) personnel, will, upon notification, mark all FAA cables in the vicinity of construction once, prior to the start of work. The Contractor shall be responsible for any damage to cables within three feet of the marked cable route. Should he/she damage any cables he/she shall immediately take all steps necessary for the repair of the cable. If the repair necessitates any work on the part of the local FAA personnel, the Contractor will be billed for all costs incurred.

2. The Contractor shall minimize, as much as possible, locations where haul routes will cross earth buried FAA cable. At such crossing points, the cable must be protected with steel boilerplate or a similar structural device.

3. At times when either threshold is displaced or equipment is operating in an ILS clear zone, that respective ILS must be taken off the air. Also, when equipment is operating between a localizer antenna and its associated landing threshold, that localizer must be taken off the air. The work must be closely coordinated with the local AFSFO to eliminate unnecessary shutdowns.

40.SP Runway Surface Condition Sensors

This item shall consist of the removal of an existing runway surface condition sensor system and replacement with an equivalent system. The existing "SSI FP-2000" in-pavement sensors and "SSI S16UG-D" subsurface probes shall be protected, removed, and provided to the owner.

All of the following items shall be included in the final price:

1. Investigation and associated survey of a replacement runway surface condition sensor system
2. Removal of existing sensors, subsurface probes, and associated power and control equipment
3. Pavement demolition and repair related to the removal and replacement of the sensors and control equipment
4. Installation of cable, conduit, and lightning protection counterpoise as necessary to maintain system functionality
5. Installation of new runway surface condition sensors and associated power and control equipment
6. Replacement of the existing Remote Processing Units (RPU's)
7. Replacement of cable.

The system components shall meet the requirements of AC 150/5220-16E, Automated Weather Observing Systems (AWOS) for Non-Federal Applications, AC 150/5200-30D, Airport Field Condition Assessments and Winter Operations Safety, AC 150/5220-13, Runway Surface Sensor Specification Guide, and the most current version of the Airport Improvement Program Handbook.

The Contractor shall submit for approval by the Engineer, prior to purchase or installation, submittals for all items required for the work.

Payment for Special Provision Item "Runway Surface Condition Sensors" shall be lump sum. This price shall be full compensation for performing the work specified and for furnishing all materials, labor, tools, and incidentals necessary to complete the item, and paid once accepted as an operational system by the Engineer and Owner.

41.SP In-Pavement Manhole Adjustment

This item shall consist of the adjusting to grade of existing manhole frames and concrete slabs. This shall be completed with the installation of a riser ring and placement of additional concrete as specified in the plans.

The Contractor shall be responsible for determining the exact height adjustment to raise or lower the top of each manhole to the new elevations. The existing top elevation of each manhole to be adjusted shall be determined in the field and subtracted/added from the proposed top elevation.

The Contractor shall remove/extend the existing top section or ring and cover on the manhole structure or manhole access. The Contractor shall install precast concrete sections or grade rings of the required dimensions to adjust the manhole top to the new proposed elevation or shall cut the existing manhole walls to shorten the existing structure, as required by final grades. The Contractor shall reinstall the manhole top section or ring and cover on top and check the new top elevation.

The Contractor shall construct a concrete slab around the top of the adjusted structures, the concrete slab shall conform to the detail shown on the plans.

The Contractor shall submit all items required for the work for approval by the Engineer, prior to purchase and installation.

Payment for Special Provision Item “In-Pavement Manhole Adjustment” shall be made at the contract unit price per each manhole modified by the Contractor and accepted by the Engineer. The unit price shall be full compensation for perform in the work specified and for furnishing all materials, labor, tools, and incidentals necessary to complete the item.

END OF SPECIAL PROVISIONS

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FAA Specifications

for

Rehabilitate Runway 6-24

at

Roanoke-Blacksburg Airport

Version:

AC 150/5370-10H Standard Specifications for Construction of Airports

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

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

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

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

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

The organizational chart shall identify all QC staff by name and function, and shall indicate the total staff required to implement all elements of the CQCP, including inspection and testing for each item of work. If necessary, different technicians can be used for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the CQCP, the personnel assigned shall be subject to the qualification requirements of paragraphs 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

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

a. Program Administrator. The Contractor Quality Control Program Administrator (CQCPA) must be a full-time employee of the Contractor, or a consultant engaged by the Contractor. The CQCPA must

have a minimum of five (5) years of experience in QC pavement construction with prior QC experience on a project of comparable size and scope as the contract.

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

- (1) Professional Engineer with one (1) year of airport paving experience.
- (2) Engineer-in-training with two (2) years of airport paving experience.
- (3) National Institute for Certification in Engineering Technologies (NICET) Civil Engineering Technology Level IV with three (3) years of airport paving experience.
- (4) An individual with four (4) years of airport paving experience, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.

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

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

The QC technicians must report directly to the CQCPA and shall perform the following functions:

- (1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by paragraph 100-6.
- (2) Performance of all QC tests as required by the technical specifications and paragraph 100-8.
- (3) Performance of tests for the Engineer when required by the technical specifications.

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

c. Staffing levels. The Contractor shall provide sufficient qualified QC personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The CQCP shall state where different technicians will be required for different work elements.

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

100-5 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include as a minimum:

- a. Specification item number
- b. Item description

- c. Description of submittal
- d. Specification paragraph requiring submittal
- e. Scheduled date of submittal

100-6 Inspection requirements. QC inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by paragraph 100-9.

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

a. During plant operation for material production, QC test results and periodic inspections shall be used to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment used in proportioning and mixing shall be inspected to ensure its proper operating condition. The CQCP shall detail how these and other QC functions will be accomplished and used.

b. During field operations, QC test results and periodic inspections shall be used to ensure the quality of all materials and workmanship. All equipment used in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The CQCP shall document how these and other QC functions will be accomplished and used.

100-7 Contractor QC testing facility.

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

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

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

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

100-8 QC testing plan. As a part of the overall CQCP, the Contractor shall implement a QC testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional QC tests that the Contractor deems necessary to adequately control production and/or construction processes.

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

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

- b. Item description (e.g., Hot Mix Asphalt Pavements)
- c. Test type (e.g., gradation, grade, asphalt content)
- d. Test standard (e.g., ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)
- e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated)
- f. Responsibility (e.g., plant technician)
- g. Control requirements (e.g., target, permissible deviations)

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

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

100-9 Documentation. The Contractor shall maintain current QC records of all inspections and tests performed. These records shall include factual evidence that the required QC inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Engineer 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 Engineer 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 Engineer 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 Engineer. All items of material and equipment are subject to inspection and/or observation by the Engineer 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 Engineer at the site for the same purpose.

Inspection and/or observations by the Engineer 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 Engineer 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 Engineer will recommend the Owner take the following actions:

- (1) Order the Contractor to replace ineffective or unqualified QC personnel or subcontractors and/or
- (2) Order the Contractor to stop operations until appropriate corrective actions are taken.

METHOD OF MEASUREMENT

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

- a. With first pay request, 25% with approval of CQCP and completion of the Quality Control (QC)/Quality Assurance (QA) workshop.
- b. When 25% or more of the original contract is earned, an additional 25%.
- c. When 50% or more of the original contract is earned, an additional 20%.
- d. When 75% or more of the original contract is earned, an additional 20%.
- e. After final inspection and acceptance of project, the final 10%.

BASIS OF PAYMENT

100-14 Payment will be made under:

Item C-100 Contractor Quality Control Program (CQCP) - per lump sum

REFERENCES

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

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

END OF ITEM C-100

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Item C-105 Mobilization

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

105-2 Mobilization limit. Mobilization shall be limited to 10 percent of the total project cost. The mobilization amount shall be documented in accordance with the Special Provisions. Any mobilization costs over the stated percentage will be paid for on an as-incurred basis. Any non-incurred costs will not be paid.

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. The Contractor shall provide dedicated space for the use of the field RPR and inspectors, as a field office for the duration of the project. This space shall be located conveniently near the construction and shall be separate from any space used by the Contractor. The Contractor shall furnish water, sanitary facilities, heat, air conditioning, and electricity in accordance with local building codes.

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

BASIS OF PAYMENT

105-6 Payment will be made under:

Item C-105 Mobilization - per lump sum

REFERENCES

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

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246, as amended

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

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

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

END OF ITEM C-105

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

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

Where: L = specification lower tolerance limit

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

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

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

and

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

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

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

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

Where: P_L = percent within lower specification limit
 P_U = percent within upper specification limit

EXAMPLE OF PWL CALCULATION

Project: Example Project

Test Item: Item P-401, Lot A.

A. PWL Determination for Mat Density.

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

$$A-1 = 96.60$$

$$A-2 = 97.55$$

$$A-3 = 99.30$$

$$A-4 = 98.35$$

$$n = 4$$

2. Calculate average density for the lot.

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

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

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

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 1.435 is less than 1.463, the value is not an outlier.

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

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

OR

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

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

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
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 (PL and PU)	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
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	-1.1173	-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

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Part 3 – Sitework

Item P-101 Preparation/Removal of Existing Pavements

DESCRIPTION

101-1 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 All equipment and materials shall be specified here and in the following paragraphs or approved by the Engineer. The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of existing pavement. 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.

a. Concrete pavement removal. Section not used.

b. Asphalt pavement removal. 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. All removed pavement shall be disposed of off Airport property.

c. 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 RPR. 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 Preparation of joints and cracks prior to overlay/surface treatment.

Cracks and joints greater than 3/4 inch wide shall be filled as shown on the plans.

101-3.3 Removal of Foreign Substances/contaminates prior to overlay or remarking. Removal of foreign substances/contaminates from existing pavement that will affect the bond of the new treatment shall consist of removal of rubber, fuel spills, oil, crack sealer, at least 90% of paint, and other foreign substances from the surface of the pavement. Areas that require removal are designated on the plans and as directed by the Engineer in the field during construction.

High-pressure water or Rotary grinding may be used.

If chemicals are used, they shall comply with the state's environmental protection regulations.

Removal methods used shall not cause major damage to the pavement, or to any structure or utility within or adjacent to the work area. Major damage is defined as changing the properties of the pavement, removal of asphalt causing the aggregate to ravel, or removing pavement over 1/8 inch (3 mm) deep. If it is deemed by the Engineer that damage to the existing pavement is caused by operational error, such as

permitting the application method to dwell in one location for too long, the Contractor shall repair the damaged area without compensation and as directed by the Engineer.

Removal of foreign substances shall not proceed until approved by the Engineer. Water used for high-pressure water equipment shall be provided by the Contractor at the Contractor's expense. No material shall be deposited on the pavement shoulders. All wastes shall be disposed of in areas indicated in this specification or shown on the plans.

101-3.4 Concrete spall or failed asphaltic concrete pavement repair. 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 underlying 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 and disposed of 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 Engineer shall layout the area to be milled with a straightedge in increments of 1-foot 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 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 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 off the Airport.

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. 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. Section not used.

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

101-3.10 Removal of Pipe and Other Buried Structures. Section not used.

METHOD OF MEASUREMENT

101-4.1 Pavement removal. The unit of measurement for pavement removal shall be the number of square yards (square meters) removed by the Contractor. Any pavement removed outside the limits of removal because the pavement was damaged by negligence on the part of the Contractor shall not be included in the measurement for payment. No direct measurement or payment shall be made for saw cutting. Saw cutting shall be incidental to pavement removal.

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

101-4.3 Removal of Foreign Substances/contaminates. Foreign substances/contaminates removal shall be incidental to the project. No measurement shall be made.

101-4.4 Spalled and failed asphalt pavement repair. Section not used.

101-4.5 Concrete Spall Repair. Section not used.

101-4.6 Cold milling. The unit of measure for cold milling shall be per square yard. The location and average depth of the cold milling shall be as shown on the plans. If the initial cut does not correct the condition, the Contractor shall re-mill the area and will be paid for the total depth of milling.

BASIS OF PAYMENT

101-5.1 Payment. Payment shall be made at the contract unit price for the unit of measurement as specified above. This price shall be full compensation for furnishing all materials and for all preparation, removal, hauling, and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Item P-101-5.1 Pavement Removal - per square yard

Item P-101-5.2 Joint and Crack Repair - per linear foot

Item P-101-5.6 Cold Milling (Type) - 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.

Advisory Circulars (AC)

AC 150/5380-6 Guidelines and Procedures for Maintenance of Airport Pavements

ASTM International (ASTM)

ASTM D6690 Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

END OF ITEM P-101

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Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

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

a. Muck Excavation. Muck excavation shall consist of the removal and disposal of deposits or mixtures of soils and organic matter not suitable for foundation material. Muck shall include materials that will decay or produce subsidence in the embankment. It may consist of decaying stumps, roots, logs, humus, or other material not satisfactory for incorporation in the embankment.

152-1.3 Unsuitable excavation. Unsuitable material shall be disposed of in designated waste areas as shown on the plans. 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 Engineer.

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 Engineer. 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 Engineer.

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

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, to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches 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 Engineer, 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.

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 Engineer has obtained from the Contractor the survey notes of the elevations and measurements of the ground surface. The Contractor and Engineer 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.

All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the Engineer. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes 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 Engineer. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the Engineer shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

b. Undercutting. 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 below the subgrade or to the depth specified by the Engineer. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed 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 for "Muck Excavation." The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans. Undercutting will be paid as "Muck Excavation."

c. Over-break. Section not used.

d. Removal of utilities. Section not used.

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

152-2.4 Drainage excavation. Section not used.

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 12 inches of subgrade shall be compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. 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.

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 and shall then be compacted per paragraph 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 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 Engineer, 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 upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The Engineer 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 Engineer. 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 Engineer.

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 nor more than 12 inches 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 Engineer. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained 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 Engineer will take samples of excavated materials which will be used in embankment for testing and develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with ASTM D1557. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the Engineer for each lift which is required to be compacted, or other appropriate frequencies as determined by the Engineer.

If the material has greater than 30% retained on the 3/4-inch 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 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. Under all areas to be paved, the embankments shall be compacted to a depth of 12 inches and to a density of not less than 100% of the maximum density as determined by ASTM D1557. 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.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches which shall be prepared for a seedbed in accordance with Item T-901.

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. The Engineer shall perform all density tests. If the specified density is not attained, the area represented by the test or as designated by the Engineer 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 in their greatest dimensions will not be allowed in the top 12 inches of the subgrade. Rockfill shall be brought up in lifts as specified or as directed by the Engineer 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 Engineer.

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 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 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 muck excavation.

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 Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to 100 psi in the presence of the Engineer. Apply a minimum of 2 (two) coverages, or as specified by the Engineer, 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 or show permanent deformation greater than 1 inch 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 of 12 inches and to a density of not less than 100% of the maximum dry density as determined by ASTM D1557. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of 12 inches and to a density of not less than 95% of the maximum density as determined by ASTM D1557.

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 sieve, follow the methods in ASTM D1557. Tests for moisture content and compaction will be taken at a minimum of 3,000 square yards of subgrade. All quality assurance testing shall be done by the Engineer.

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.

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 Engineer 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 Engineer.

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, reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the Engineer. The Contractor shall perform all final smoothness and grade checks in the

presence of the Engineer. 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 when tested with a 12-foot 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 straightedge for the full length of each line on a 50-foot grid.

b. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within ± 0.05 feet 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 from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.14 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the Engineer, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further re-handling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans and as required in Item T-905. Topsoil shall be paid for as provided in Item T-905. No direct payment will be made for topsoil under Item P-152.

METHOD OF MEASUREMENT

152-3.1 The quantity of muck excavation to be paid for shall be the number of cubic yards measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

BASIS OF PAYMENT

152-4.1 Excavation. Payment for muck excavation shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-152-4.1 Muck Excavation - per cubic 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.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T-180 Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

ASTM International (ASTM)

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 D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Advisory Circulars (AC)

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

FAARFIELD	– FAA Rigid and Flexible Iterative Elastic Layered Design
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U.S. Department of Transportation

FAA RD-76-66	Design and Construction of Airport Pavements on Expansive Soils
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Item P-153 Controlled Low-Strength Material (CLSM)**DESCRIPTION**

153-1.1 This item shall consist of furnishing, transporting, and placing a controlled low-strength material (CLSM) as flowable backfill in trenches or at other locations shown on the plans or as directed by the Engineer.

MATERIALS**153-2.1 Materials.**

a. Cement. Cement shall conform to the requirements of ASTM C150 - Types I, II, or V.

b. Fly ash. Fly ash shall conform to ASTM C618, Class C or F.

c. Fine aggregate (sand). Fine aggregate shall conform to the requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces the specified performance characteristics of the CLSM and meets the following requirements will be accepted.

Sieve Size	Percent Passing by weight
3/4 inch (19.0 mm)	100
No. 200 (75 µm)	0 - 12

d. 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.

MIX DESIGN

153-3.1 Proportions. The Contractor shall submit, to the Engineer, a mix design including the proportions and source of aggregate, fly ash, cement, water, and approved admixtures. No CLSM mixture shall be produced for payment until the Engineer has given written approval of the proportions. The proportions shall be prepared by a laboratory and shall remain in effect for the duration of the project. The proportions shall establish a single percentage or weight for aggregate, fly ash, cement, water, and any admixtures proposed. Laboratory costs are incidental to this item.

a. Compressive strength. CLSM shall be designed to achieve a 28-day compressive strength of 100 to 200 psi (690 to 1379 kPa) when tested in accordance with ASTM D4832, with no significant strength gain after 28 days.

b. Consistency. Design CLSM to achieve a consistency that will produce an approximate 8-inch (200 mm) diameter circular-type spread without segregation. CLSM consistency shall be determined per ASTM D6103.

CONSTRUCTION METHODS**153-4.1 Placement.**

a. Placement. CLSM may be placed by any reasonable means from the mixing unit into the space to be filled. Agitation is required during transportation and waiting time. Placement shall be performed so

structures or pipes are not displaced from their final position and intrusion of CLSM into unwanted areas is avoided. The material shall be brought up uniformly to the fill line shown on the plans or as directed by the Engineer. Each placement of CLSM shall be as continuous an operation as possible. If CLSM is placed in more than one lift, the base lift shall be free of surface water and loose foreign material prior to placement of the next lift.

b. Contractor Quality Control. The Contractor shall collect all batch tickets to verify the CLSM delivered to the project conforms to the mix design. The Contractor shall verify daily that the CLSM is consistent with 153-3.1a and 153-3.1b. Adjustments shall be made as necessary to the proportions and materials as needed. The Contractor shall provide all batch tickets to the Engineer.

c. Limitations of placement. CLSM shall not be placed on frozen ground. Mixing and placing may begin when the air or ground temperature is at least 35°F (2°C) and rising. Mixing and placement shall stop when the air temperature is 40°F (4°C) and falling or when the anticipated air or ground temperature will be 35°F (2°C) or less in the 24-hour period following proposed placement. At the time of placement, CLSM shall have a temperature of at least 40°F (4°C).

153-4.2 Curing and protection

a. Curing. The air in contact with the CLSM shall be maintained at temperatures above freezing for a minimum of 72 hours. If the CLSM is subjected to temperatures below 32°F (0°C), the material may be rejected by the Engineer if damage to the material is observed.

b. Protection. The CLSM shall not be subject to loads and shall remain undisturbed by construction activities for a period of 48 hours or until a compressive strength of 15 psi (105 kPa) is obtained. The Contractor shall be responsible for providing evidence to the Engineer that the material has reached the desired strength. Acceptable evidence shall be based upon compressive tests made in accordance with paragraph 153-3.1a.

153-4.3 Quality Assurance (QA) Acceptance. CLSM QA acceptance shall be based upon batch tickets provided by the Contractor to the Engineer to confirm that the delivered material conforms to the mix design.

METHOD OF MEASUREMENT

153-5.1 Measurement. No separate measurement for payment shall be made for controlled low strength material (CLSM). CLSM shall be considered necessary and incidental to the work of this Contract.

BASIS OF PAYMENT

153-6.1 Payment. No payment will be made separately or directly for controlled low strength material (CLSM). CLSM shall be considered necessary and incidental to the work of this Contract.

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 C33

Standard Specification for Concrete Aggregates

ASTM C150

Standard Specification for Portland Cement

ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D4832	Standard Test Method for Preparation and Testing of Controlled Low-Strength Material (CLSM) Test Cylinders
ASTM D6103	Flow Consistency of Controlled Low Strength Material (CLSM)

END OF ITEM P-153

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Part 4 – Base Courses

Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone or crushed gravel and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable.

Fine aggregate portion, defined as the portion passing the No. 4 (4.75 mm) sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone or gravel that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.

Crushed Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 45% maximum	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
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 98% with at least one fractured face ¹	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles ²	ASTM D4791
Fine Aggregate		
Liquid limit	Less than or equal to 25	ASTM D4318
Plasticity Index	Not more than five (5)	ASTM D4318

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).

209-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

Gradation of Aggregate Base

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances ¹ (Percent)
2 inch (50 mm)	100		0
1-1/2 inch (37.5 mm)	95-100		±5
1 inch (25.0 mm)	70-95		±8
3/4 inch (19.0 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40 (425 µm) ²	10-30		±5
No. 200 (75 µm) ²	0-10		±3

¹ The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

² The fraction of material passing the No 200 (75 µm) sieve shall not exceed two-thirds the fraction passing the No 40 (425 µm) sieve.

209-2.3 Sampling and Testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

b. Gradation requirements. The Contractor shall take at least two aggregate base samples per day in the presence of the Engineer to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the Engineer.

209-2.4 Separation Geotextile. Not used.

CONSTRUCTION METHODS

209-3.1 Control strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the Engineer, 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. 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 Engineer 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 continue until the control strip has been accepted by the Engineer. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved by the Engineer.

209-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the Engineer before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the Contractor's expense, may be required by the Engineer if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper

drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.5, the approved material may be transported directly to the placement.

209-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the Engineer, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches (100 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 at the Contractor's expense.

209-3.5 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The moisture content of the material during placing operations shall be within ± 2 percentage points of the optimum moisture content as determined by ASTM D1557. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

209-3.6 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F (4°C) and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

209-3.7 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.

209-3.8 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and recompact to grade until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8-inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall

be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade.

209-3.9 Acceptance sampling and testing. Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1200 square yards. Sampling locations will be determined on a random basis per ASTM D3665.

a. Density. The Engineer shall perform all density tests. Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the 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. Depth tests shall be made by test holes at least 3 inches (75 mm) in diameter that extend through the base. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by depth tests taken by the Contractor in the presence of the Engineer for each area. Where the thickness is deficient by more than 1/2-inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

METHOD OF MEASUREMENT

209-4.1 The quantity of crushed aggregate base course will be determined by measurement of the number of cubic yards of material actually constructed and accepted by the Engineer as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

209-5.1 Payment shall be made at the contract unit price per cubic yard for crushed aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-209-5.1 Crushed Aggregate Base Course - per cubic yard

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 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 D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2700 kN-m/m ³))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM 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 D4643	Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating
ASTM D4751	Standard Test Methods for Determining Apparent Opening Size of a Geotextile
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
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-401 Asphalt Mix Pavement

DESCRIPTION

401-1.1 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 base or stabilized course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

401-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, 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	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	1.0 % maximum	ASTM C142
Percentage of Fractured Particles	For pavements designed for aircraft gross weights of 60,000 pounds 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
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 ²	ASTM D4791
Bulk density of slag ³	Weigh not less than 70 pounds per cubic foot	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 fine

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	1.0% maximum	ASTM C142
Sand equivalent	45 minimum	ASTM D2419
Natural Sand	0% to 15% maximum by weight of total aggregate ¹	ASTM D1073

¹ If natural sand is used, use the minimum amount necessary to achieve a workable mixture, not to exceed 15% by weight of total aggregate.

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate.

401-2.2 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

401-2.3 Asphalt binder. Asphalt binder shall conform to ASTM D6373 Performance Grade (PG) 76-22.

Asphalt Binder PG Plus Test Requirements

Material Test	Requirement	Standard
Elastic Recovery	75% minimum	ASTM D6084 ¹

¹ Follow procedure B on RTFO aged binder.

401-2.4 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

401-3.1 Composition of mixture(s). The asphalt mix shall be composed of a mixture of aggregates, filler and anti-strip agent if required, and asphalt binder. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).

401-3.2 Job mix formula (JMF) 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 be listed on the accrediting authority's website. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the Engineer prior to start of construction.

401-3.3 Job mix formula (JMF). No asphalt mixture shall be placed until an acceptable mix design has been submitted to the Engineer for review and accepted in writing. The Engineer'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 paragraph 401-3.2. 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 Engineer for review and accepted in writing before the new material is used. After the initial production JMF has been approved by the Engineer and a new or modified JMF is required for whatever reason, the subsequent cost of the new or modified JMF, including a new control strip when required by the Engineer, will be borne by the Contractor.

The Engineer 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 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 paragraph 401-2.3. 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 paragraph 401-2.4.
- Certified material test reports for the course and fine aggregate and mineral filler in accordance with paragraphs 401-2.1.
 - 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 coarse 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 field mixing and compaction temperatures.
 - Plot of the combined gradation on a 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.
- Asphalt Pavement Analyzer (APA) 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 mix pavement (RAP) in accordance with paragraph 401-3.4.

Table 1. Asphalt Design Criteria

Test Property	Value	Test Method
Number of blows or gyrations	75	
Air voids (%)	3.5	ASTM D3203
Percent voids in mineral aggregate (VMA), minimum	See Table 2	ASTM D6995
Tensile Strength Ratio (TSR) ¹	not less than 80 at a saturation of 70-80%	ASTM D4867
Asphalt Pavement Analyzer (APA) ^{2,3}	Less than 10 mm @ 4000 passes	AASHTO T340 at 250 psi hose pressure at 64°C test temperature

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.

² AASHTO T340 at 100 psi hose pressure at 64°C test temperature may be used in the interim. If this method is used the required Value shall be less than 5 mm @ 8000 passes.

³ Where APA not available, Hamburg Wheel test (AASHTO T-324) 10mm @ 20,000 passes at 50°C may be used with prior approval from the FAA ADO.

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		
	Gradation 1	Gradation 2	Gradation 3
1 inch (25.0 mm)	--	--	--
3/4 inch (19.0 mm)	--	100	--
1/2 inch (12.5 mm)	--	90-100	--
3/8 inch (9.5 mm)	--	72-88	--
No. 4 (4.75 mm)	--	53-73	--
No. 8 (2.36 mm)	--	38-60	--
No. 16 (1.18 mm)	--	26-48	--
No. 30 (600 µm)	--	18-38	--
No. 50 (300 µm)	--	11-27	--
No. 100 (150 µm)	--	6-18	--
No. 200 (75 µm)	--	3-6	--
Minimum Voids in Mineral Aggregate (VMA)¹	--	15.0	--
Asphalt percent by total weight of mixture:			
Stone or gravel	--	5.0-7.5	--
Slag	--	6.5-9.5	--
Recommended Minimum Construction Lift Thickness	--	3 inch	--

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

Gradation 3 shall be used for leveling courses only.

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

401-3.4 Reclaimed asphalt pavement (RAP). RAP shall not be used.

401-3.5 Control Strip. Full production shall not begin until an acceptable control strip has been constructed and accepted in writing by the Engineer.

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 401-5.1, has been accepted, in writing, by the Engineer.

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 401-4.14 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 will be considered acceptable by the Engineer if the gradation, asphalt content, and VMA are within the action limits specified in paragraph 401-5.5a; and Mat density greater than or equal to 94.5%, air voids 3.5% +/- 1%, and joint density greater than or equal to 92.5%.

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 401-8.1 using a lot pay factor equal to 100.

CONSTRUCTION METHODS

401-4.1 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 Engineer, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

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

401-4.2 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 Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

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 Engineer determines there is an excessive heat loss, segregation, or oxidation of the asphalt mixture due to temporary storage, temporary storage shall not be allowed.

401-4.3 Aggregate stockpile management. Aggregate stockpiles shall be constructed in a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the asphalt 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.

401-4.4 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 Engineer. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

401-4.4.1 Material transfer vehicle (MTV). Material transfer vehicles used to transfer the material from the hauling equipment to the paver, shall use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation.

401-4.5 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 paragraph 401-4.12.

401-4.6 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, clean, and 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.

401-4.7 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 supply a qualified technician during all paving operations to calibrate the gauge and obtain accurate density readings for all new asphalt. These densities shall be supplied to the Engineer upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

401-4.8 Preparation of asphalt binder. The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt binder to the mixer at a uniform temperature. The temperature of unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles but shall not exceed 325°F (160°C) when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F (175°C) when added to the aggregate.

401-4.9 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.

401-4.10 Preparation of Asphalt mixture. The aggregates and the asphalt binder shall be weighed or metered and mixed 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%.

401-4.11 Application of Tack Coat. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.

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.

401-4.12 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 Engineer.

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 Engineer that every lot of each lift meets the grade tolerances of paragraph 401-6.2d 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 Engineer. The asphalt mix shall be placed in consecutive adjacent lanes having a minimum width of 25 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 one 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 Engineer 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 Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

Areas of segregation in the surface course, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of the construction lift thickness as specified in paragraph 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.

401-4.13 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.

401-4.14 Joints. The formation of all joints shall be made 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. Asphalt tack coat in accordance with P-603 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.

401-4.15 Saw-cut grooving. Saw-cut grooves shall be provided as specified in Item P-621.

401-4.16 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 sufficient number of blades to create 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 cause ravels, aggregate fractures, spalls, or disturbance to the pavement will not be permitted. Contractor shall demonstrate to the Engineer that the grinding equipment will produce satisfactory results prior to making corrections to surfaces. 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.

401-4.17 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 Engineer 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)

401-5.1 General. The Contractor shall develop a Contractor Quality Control Program (CQCP) in accordance with Item C-100. No partial payment will be made for materials without an approved CQCP.

401-5.2 Contractor quality control (QC) facilities. The Contractor shall provide, or contract for, testing facilities in accordance with Item C-100. The Engineer shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The Engineer 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.

401-5.3 Contractor 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 day from mechanical analysis of extracted aggregate in accordance with ASTM D5444, ASTM C136, and ASTM C117.

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

d. Moisture content of asphalt. The moisture content shall be determined once per day in accordance with AASHTO T329 or ASTM D1461.

e. Temperatures. Temperatures shall be checked, at least four times per day, 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 1/4 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 Engineer. 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 either the FAA profile program, ProFAA, or FHWA ProVal, 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 shall be taken perpendicular to the pavement centerline each 50 feet (15 m) or more often as determined by the Engineer. 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 shall 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. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

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 paragraph 401-4.16 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 paragraph 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 and after the placement of the first lift 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 vertically and 0.1 feet laterally. The documentation will be provided by the Contractor to the Engineer within 24 hours.

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 paragraph 401-4.16.

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.

401-5.4 Sampling. When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

401-5.5 Control charts. The Contractor shall maintain linear control charts for both individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each day will be calculated and monitored by the QC laboratory.

Control charts shall be posted in a location satisfactory to the Engineer 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 Engineer may suspend production or acceptance of the material.

a. Individual measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The control charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits for Individual Measurements

Sieve	Action Limit	Suspension Limit
3/4 inch (19.0 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 shall be established to control gradation process variability. The range shall be plotted 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

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 rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

- (1) One point falls outside the Suspension Limit line for individual measurements or range; or
- (2) Two points in a row fall outside the Action Limit line for individual measurements.

401-5.6 QC reports. The Contractor shall maintain records and shall submit reports of QC activities daily, in accordance with Item C-100.

MATERIAL ACCEPTANCE

401-6.1 Acceptance sampling and testing. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer at no cost to the Contractor except that coring as required in this section shall be completed and paid for by the Contractor.

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 three compacted specimens prepared in accordance with ASTM D6925.

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 inch (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 Engineer.

(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 Engineer to determine the extent of unbonded areas. Unbonded areas shall be removed by milling and replaced at no additional cost as directed by the Engineer.

(3) Thickness. Thickness of each lift of surface course will be evaluated by the Engineer 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 Engineer to circumscribe the deficient area.

(4) Mat density. One core shall be taken from each subplot. Core locations will be determined by the Engineer 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 that has a longitudinal joint. Core locations will be determined by the Engineer 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.

401-6.2 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, grade.

b. Air Voids and Mat density. Acceptance of each lot of plant produced material for mat density and air voids will be based on the percentage of material within specification limits (PWL). If the PWL of the lot equals or exceeds 90%, the lot will be acceptable. Acceptance and payment will be determined in accordance with paragraph 401-8.1.

c. Joint density. Acceptance of each lot of plant produced asphalt for joint density will be based on the PWL. If the PWL of the lot is equal to or exceeds 90%, the lot will be considered acceptable. If the PWL is less than 90%, the Contractor shall evaluate the reason and act accordingly. If the PWL is less than 80%, the Contractor shall cease operations and until the reason for poor compaction has been determined. If the PWL is less than 71%, the pay factor for the lot used to complete the joint will be reduced by five (5) percentage points. This lot pay factor reduction will be incorporated and evaluated in accordance with paragraph 401-8.1.

d. Grade. The final finished surface of the pavement shall be surveyed to verify that the grade elevations and cross-sections shown on the plans do not deviate more than 1/2 inch vertically.

Cross sections of the pavement shall be taken at a minimum 50-foot longitudinal spacing, at all longitudinal grade breaks, and at start and end of each lane placed. Minimum cross-section grade points shall include grade at centerline, ± 10 feet of centerline, and edge of runway and taxiway pavement.

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%.

e. Profilograph roughness for QA Acceptance. Not used.

401-6.3 Percentage of material within specification limits (PWL). The PWL will be determined in accordance with procedures specified in Item C-110. The specification tolerance limits (L) for lower and (U) for upper are contained in Table 5.

Table 5. Acceptance Limits for Air Voids and Density

Test Property	Pavements Specification Tolerance Limits	
	L	U
Air Voids Total Mix (%)	2.0	5.0
Surface Course Mat Density (%)	92.8	--
Base Course Mat Density (%)	92.0	--
Joint density (%)	90.5	--

a. Outliers. All individual tests for mat density and air voids will be checked for outliers (test criterion) in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded, and the PWL will be determined using the remaining test values. The criteria in Table 5 is based on production processes which have a variability with the following standard deviations: Surface Course Mat Density (%), 1.30; Base Course Mat Density (%), 1.55; Joint Density (%), 1.55.

The Contractor should note that (1) 90 PWL is achieved when consistently producing a surface course with an average mat density of at least 94.5% with 1.30% or less variability, (2) 90 PWL is achieved when consistently producing a base course with an average mat density of at least 94.0% with 1.55% or less variability, and (3) 90 PWL is achieved when consistently producing joints with an average joint density of at least 92.5% with 1.55% or less variability.

401-6.4 Resampling pavement for mat density.

a. General. Resampling of a lot of pavement will only be allowed for mat density, and then, only if the Contractor requests same, in writing, within 48 hours after receiving the written test results from the Engineer. A retest will consist of all the sampling and testing procedures contained in paragraphs 401-6.1d and 401-6.2b. Only one resampling per lot will be permitted.

(1) A redefined PWL will be calculated for the resampled lot. The number of tests used to calculate the redefined PWL 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 PWL for a resampled lot will be used to calculate the payment for that lot in accordance with Table 6.

c. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%.

401-6.5 Leveling course. The leveling course is the first variable thickness lift placed to correct surface irregularities prior to placement of subsequent courses. The leveling course shall meet the aggregate gradation in Table 2, paragraph 401-3.3. The leveling course shall meet the requirements of paragraph 401-3.3, 401-6.2b for air voids, but shall not be subject to the density requirements of paragraph 401-6.2b for mat density and 401-6.2c for joint density. The leveling course shall be compacted with the same effort used to achieve density of the control strip. The leveling course shall not exceed the lift thickness associated with each gradation in Table 2, paragraph 401-3.3.

METHOD OF MEASUREMENT

401-7.1 Measurement. Asphalt shall be measured by the number of tons of asphalt used in the accepted work. Batch weights or truck scale weights will be used to determine the basis for the tonnage.

BASIS OF PAYMENT

401-8.1 Payment. Payment for a lot of asphalt meeting all acceptance criteria as specified in paragraph 401-6.2 shall be made based on results of tests for mat density and air voids. Payment for acceptable lots shall be adjusted according to paragraph 401-8.1c for mat density and air voids; and paragraph 401-6.2c for joint density, subject to the limitation that:

- a. The total project payment for plant mix asphalt pavement shall not exceed 100 percent of the product of the contract unit price and the total number of tons of asphalt used in the accepted work.
- b. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

c. Basis of adjusted payment. The pay factor for each individual lot shall be calculated in accordance with Table 6. A pay factor shall be calculated for both mat density and air voids. The lot pay factor shall be the higher of the two values when calculations for both mat density and air voids are 100% or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either mat density or air voids is 100% or higher. The lot pay factor shall be the lower of the two values when calculations for both mat density and air voids are less than 100%. If PWL for joint density is less than 71% then the lot pay factor shall be reduced by 5% but be no higher than 95%.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph 401-8.1a. Payment in excess of 100% for accepted lots of asphalt shall be used to offset payment for accepted lots of asphalt pavement that achieve a lot pay factor less than 100%.

Payment for sublots which do not meet grade in accordance with paragraph 401-6.2d after correction for over 25% of the subplot shall be reduced by 5%.

Table 6. Price adjustment schedule¹

Percentage of material within specification limits (PWL)	Lot pay factor (percent of contract unit price)
96 – 100	106
90 – 95	PWL + 10
75 – 89	0.5 PWL + 55
55 – 74	1.4 PWL – 12
Below 55	Reject ²

¹ Although it is theoretically possible to achieve a pay factor of 106% for each lot, actual payment above 100% shall be subject to the total project payment limitation specified in paragraph 401-8.1a.

² The lot shall be removed and replaced. However, the Engineer may decide to allow the rejected lot to remain. In that case, if the Engineer and Contractor agree in writing that the lot shall not be removed, it shall be paid for at 50% of the contract unit price and the total project payment shall be reduced by the amount withheld for the rejected lot.

d. Profilograph Roughness. Not used.

401-8.1 Payment.

Payment will be made under:

Item P-401-8.1 Asphalt Surface Course - per ton

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 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 Asphalt Paving Mixtures
ASTM D1073	Standard Specification for Fine Aggregate for Asphalt Paving Mixtures
ASTM D1188	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
ASTM D2172	Standard Test Method for Quantitative Extraction of Bitumen from Asphalt Paving Mixtures
ASTM D1461	Standard Test Method for Moisture or Volatile Distillates in Asphalt Paving Mixtures
ASTM D2041	Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489	Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D2726	Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D2950	Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods

ASTM D3203	Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM 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 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 D5361	Standard Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
ASTM D5444	Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6084	Standard Test Method for Elastic Recovery of Bituminous Materials by Durometer
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 E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph
ASTM E950	Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

ASTM E2133	Standard Test Method for Using a Rolling Inclinometer 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 T324	Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures
AASHTO T340	Standard Method of Test for Determining the Rutting Susceptibility of Hot Mix Asphalt (APA) Using the Asphalt Pavement Analyzer (APA)
Asphalt Institute (AI)	
Asphalt Institute Handbook MS-26, Asphalt Binder	
Asphalt Institute MS-2 Mix Design Manual, 7th Edition	
AI State Binder Specification Database	
Federal Highway Administration (FHWA)	
Long Term Pavement Performance Binder Program	
Advisory Circulars (AC)	
AC 150/5320-6	Airport Pavement Design and Evaluation
FAA Orders	
5300.1	Modifications to Agency Airport Design, Construction, and Equipment Standards
Software	
FAARFIELD	

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Part 9 – Miscellaneous

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 Engineer 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 Engineer.

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 Engineer.

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 Engineer prior to application.

Emulsified Asphalt

Surface Type	Residual Rate, gal/SY	Emulsion Application Bar Rate, gal/SY
New asphalt	0.02-0.05	0.03-0.07
Existing asphalt	0.04-0.07	0.06-0.11
Milled Surface	0.04-0.08	0.06-0.12
Concrete	0.03-0.05	0.05-0.08

After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of the tack coat. This period shall be determined by the Engineer. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed. 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 Engineer 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

603-4.1 The emulsified asphalt material for tack coat shall be measured by the gallon. Volume shall be corrected to the volume at 60°F (16°C) in accordance with ASTM D1250. The emulsified asphalt material paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10% over the specified application rate. Any amount of emulsified asphalt material more than 10% over the specified application rate for each application will be deducted from the measured quantities, except for irregular areas where hand spraying of the emulsified asphalt material is necessary. Water added to emulsified asphalt will not be measured for payment.

BASIS OF PAYMENT

603-5.1 Payment shall be made at the contract unit price per gallon of emulsified asphalt material. This price shall be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-603-5.1 Emulsified Asphalt Tack Coat - per gallon

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

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Item P-605 Joint Sealants for Pavements

DESCRIPTION

605-1.1 This item shall consist of providing and installing a resilient and adhesive joint sealing material capable of effectively sealing joints in pavement; joints between different types of pavements; and cracks in existing pavement.

MATERIALS

605-2.1 Joint sealants. Joint sealant materials shall meet the requirements of ASTM D5893 and shall be Dow Corning 888 or 890SL Silicone Joint Sealant, or equal approved by the Engineer.

Each lot or batch of sealant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, the safe heating temperature, and shall be accompanied by the manufacturer's certification stating that the sealant meets the requirements of this specification.

605-2.2 Backer rod. The material furnished shall be a compressible, non-shrinking, non-staining, non-absorbing material that is non-reactive with the joint sealant in accordance with ASTM D5249. The backer-rod material shall be $25\% \pm 5\%$ larger in diameter than the nominal width of the joint.

605-2.3 Bond breaking tapes. Provide a bond breaking tape or separating material that is a flexible, non-shrinkable, non-absorbing, non-staining, and non-reacting adhesive-backed tape. The material shall have a melting point at least 5°F (3°C) greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The bond breaker tape shall be approximately 1/8 inch (3 mm) wider than the nominal width of the joint and shall not bond to the joint sealant.

CONSTRUCTION METHODS

605-3.1 Time of application. Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be 50°F (10°C) and rising at the time of application of the poured joint sealing material. Do not apply sealant if moisture is observed in the joint. Weather limitations shall be in accordance with manufacturer's recommendations.

605-3.2 Equipment. Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and maintained in satisfactory condition at all times. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 14 days prior to use on the project.

a. Tractor-mounted routing tool. Section not used.

b. Concrete saw. Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified.

c. Sandblasting equipment. Sandblasting is not allowed.

d. Waterblasting equipment. The Contractor must demonstrate waterblasting equipment including the pumps, hose, guide and nozzle size, under job conditions, before approval in accordance with

paragraph 605-3.3. The Contractor shall demonstrate, in the presence of the Engineer, that the method cleans the joint and does not damage the joint.

e. Hand tools. Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces. Hand tools should be carefully evaluated for potential spalling effects prior to approval for use.

f. Hot-poured sealing equipment. Section not used.

g. Cold-applied, single-component sealing equipment. The equipment for installing ASTM D5893 single component joint sealants shall consist of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. The dimension of the nozzle shall be such that the tip of the nozzle will extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier's instructions, and unaltered in any way without obtaining prior approval. Small hand-held air-powered equipment (i.e., caulking guns) may be used for small applications.

605-3.3 Preparation of joints. Pavement joints for application of material in this specification must be dry, clean of all scale, dirt, dust, curing compound, and other foreign matter. The Contractor shall demonstrate, in the presence of the Engineer, that the method cleans the joint and does not damage the joint.

a. Sawing. All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary.

b. Sealing. Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, filler, protrusions of hardened concrete, old sealant and other foreign material from the sides and upper edges of the joint space to be sealed. Cleaning shall be accomplished by concrete saw or waterblasting as specified in paragraph 605-3.2. The newly exposed concrete joint faces and the pavement surface extending a minimum of 1/2 inch (12 mm) from the joint edge shall be sandblasted clean. ~~Sandblasting shall be accomplished in a minimum of two passes. One pass per joint face with the nozzle held at an angle directly toward the joint face and not more than 3 inches (75 mm) from it.~~ After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave them completely free of debris and water. The joint faces shall be surface dry when the seal is applied.

c. Backer Rod. When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a backer rod in accordance with paragraph 605-2.2 to prevent the entrance of the sealant below the specified depth. Take care to ensure that the backer rod is placed at the specified depth and is not stretched or twisted during installation.

d. Bond-breaking tape. Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond-separating tape breaker in accordance with paragraph 605-2.3 to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Securely bond the tape to the bottom of the joint opening so it will not float up into the new sealant.

605-3.4 Installation of sealants. Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer before sealing is allowed. Sealants shall be installed in accordance with the following requirements:

Immediately preceding, but not more than 50 feet (15 m) ahead of the joint sealing operations, perform a final cleaning with compressed air. Fill the joints from the bottom up to 1/4 inch $\pm$ 1/16 inch below the top

of pavement surface; or bottom of groove for grooved pavement. Remove and discard excess or spilled sealant from the pavement by approved methods. Install the sealant in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Engineer. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's instructions. Check the joints frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

605-3.5 Inspection. The Contractor shall inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified at no additional cost to the airport.

605-3.6 Clean-up. Upon completion of the project, remove all unused materials from the site and leave the pavement in a clean condition.

METHOD OF MEASUREMENT

605-4.1 Joint sealing material shall not be measured for payment.

BASIS OF PAYMENT

605-5.1 Payment for joint sealing material shall be incidental to the price of the other items in this contract.

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 D789	Standard Test Method for Determination of Relative Viscosity of Polyamide (PA)
ASTM D5249	Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D5893	Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

Advisory Circulars (AC)

AC 150/5340-30	Design and Installation Details for Airport Visual Aids
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Item P-606 Adhesive Compounds, Two-Component for Sealing Wire and Lights in Pavement

DESCRIPTION

606-1.1 This specification covers two types of material; a liquid suitable for sealing electrical wire in saw cuts in pavement and for sealing light fixtures or bases in pavement, and a paste suitable for embedding light fixtures in the pavement. Both types of material are two-component filled formulas with the characteristics specified in paragraph 606-2.4. Materials supplied for use with asphalt and/or concrete pavements must be formulated so they are compatible with the asphalt and/or concrete.

MATERIALS

606-2.1 Curing. When pre-warmed to 77°F (25°C), mixed, and placed in accordance with manufacturer's directions, the materials shall cure at temperatures of 45°F (7°C) or above without the application of external heat.

606-2.2 Storage. The adhesive components shall not be stored at temperatures over 86°F (30°C), unless otherwise specified by the manufacturer.

606-2.3 Caution. Installation and use shall be in accordance with the manufacturer's recommended procedures. Avoid prolonged or repeated contact with skin. In case of contact, wash with soap and flush with water. If taken internally, call doctor. Keep away from heat or flame. Avoid vapor. Use in well-ventilated areas. Keep in cool place. Keep away from children.

606-2.4 Characteristics. When mixed and cured in accordance with the manufacturer's directions, the materials shall have the following properties shown in Table 1.

Table 1. Property Requirements

Physical or Electrical Property	Minimum	Maximum	ASTM Method
Tensile			
Portland cement concrete	1,000 psi	--	D 638
Asphalt concrete	500 psi	--	--
Elongation			
Portland cement concrete	--	See note ¹	D 638
Asphalt concrete	50%	--	D 638
Coef. of cub. exp. cu. cm/cu. cm/°C	0.00090	0.00120	D 1168
Coef. of lin. exp. cm/cm/°C	0.000030	0.000040	D 1168
Dielectric strength, short time test	350 volts/mil.	--	D 149
Arc resistance	125 sec	--	--
Pull-off			
Adhesion to steel	1,000 psi	--	--
Adhesion to Portland cement concrete	200 psi	--	--
Adhesion to asphalt concrete	No test available	--	--
Adhesion to aluminum	250 psi	--	--

¹ 20% or more (without filler) for formulations to be supplied for areas subject to freezing.

SAMPLING, INSPECTION, AND TEST PROCEDURES

606-3.1 Tensile properties. Tests for tensile strength and elongation shall be conducted in accordance with ASTM D638.

606-3.2 Expansion. Tests for coefficients of linear and cubical expansion shall be conducted in accordance with, Method B, except that mercury shall be used instead of glycerine. The test specimen shall be mixed in the proportions specified by the manufacturer and cured in a glass tub approximately 2 inch (50 mm) long by 3/8 inch (9 mm) in diameter. The interior of the tube shall be precoated with a silicone mold release agent. The hardened sample shall be removed from the tube and aged at room temperature for one (1) week before conducting the test. The test temperature range shall be from 35°F (2°C) to 140°F (60°C).

606-3.3 Test for dielectric strength. Test for dielectric strength shall be conducted in accordance with ASTM D149 for sealing compounds to be furnished for sealing electrical wires in pavement.

606-3.4 Test for arc resistance. Test for arc resistance shall be conducted for sealing compounds to be furnished for sealing electrical wires in pavement.

606-3.5 Test for adhesion to steel. The ends of two smooth, clean, steel specimens of convenient size (1 inch by 1 inch by 6 inch) (25 mm by 25 mm by 150 mm) would be satisfactory when bonded together with adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure on a Riehle (or similar) tensile tester. The thickness of adhesive to be tested shall be 1/4 inch (6 mm).

606-3.6 Adhesion to Portland cement concrete.

a. Concrete test block preparation. The aggregate grading shall be as shown in Table 2.

The coarse aggregate shall consist of crushed rock having a minimum of 75% of the particles with at least one fractured face and having a water absorption of not more than 1.5%. The fine aggregate shall consist of crushed sand manufactured from the same parent rock as the coarse aggregate. The concrete shall have a water-cement ratio of 5.5 gallons (21 liters) of water per bag of cement, a cement factor of 6, ± 0.5 , bags of cement per cubic yard (0.76 cubic meter) of concrete, and a slump of 2-1/2 inch (60 mm), $\pm 1/2$ inch (60 mm ± 12 mm). The ratio of fine aggregate to total aggregate shall be approximately 40% by solid volume. The air content shall be 5.0%, $\pm 0.5\%$, and it shall be obtained by the addition to the batch of an air-entraining admixture such as Vinsol® resin. The mold shall be of metal and shall be provided with a metal base plate.

Means shall be provided for securing the base plate to the mold. The assembled mold and base plate shall be watertight and shall be oiled with mineral oil before use. The inside measurement of the mold shall be such that several one inch (25 mm) by 2-inch (75 mm) by 3-inch (25 mm by 50 mm by 75 mm) test blocks can be cut from the specimen with a concrete saw having a diamond blade. The concrete shall be prepared and cured in accordance with ASTM C192.

Table 2. Aggregate for Bond Test Blocks

Type	Sieve Size	Percent Passing
Coarse Aggregate	3/4 inch (19.0 mm)	97 to 100
	1/2 inch (12.5 mm)	63 to 69
	3/8 inch (9.5 mm)	30 to 36
	No. 4 (4.75 mm)	0 to 3
Fine Aggregate	No. 4 (4.75 mm)	100
	No. 8 (2.36 mm)	82 to 88
	No. 16 (1.18 mm)	60 to 70
	No. 30 (600 μ m)	40 to 50
	No. 50 (300 μ m)	16 to 26
	No. 100 (150 μ m)	5 to 9

b. Bond test. Prior to use, oven-dry the test blocks to constant weight at a temperature of 220°F to 230°F (104°C to 110°C), cool to room temperature, 73.4°F $\pm 3^\circ$ F (23°C $\pm 1.6^\circ$ C), in a desiccator, and

clean the surface of the blocks of film or powder by vigorous brushing with a stiff-bristled fiber brush. Two test blocks shall be bonded together on the one inch by 3 inch (25 mm by 75 mm) sawed face with the adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure in a Riehle (or similar) tensile tester. The thickness of the adhesive to be tested shall be 1/4 inch (6 mm).

606-3.7 Compatibility with asphalt mix. Test for compatibility with asphalt in accordance with ASTM D5329.

606-3.8 Adhesive compounds - Contractor's responsibility. The Contractor shall furnish the vendor's certified test reports for each batch of material delivered to the project. The report shall certify that the material meets specification requirements and is suitable for use with concrete and asphalt concrete pavements. The report shall be provided to and accepted by the Engineer before use of the material. In addition, the Contractor shall obtain a statement from the supplier or manufacturer that guarantees the material for one year. The supplier or manufacturer shall furnish evidence that the material has performed satisfactorily on other projects.

606-3.9 Application. Adhesive shall be applied on a dry, clean surface, free of grease, dust, and other loose particles. The method of mixing and application shall be in strict accordance with the manufacturer's recommendations. When used with Item P-605, such as light can installation, Item P-605 shall not be applied until the Item P-606 has fully cured.

METHOD OF MEASUREMENT

606-4.1 The adhesive compound shall not be measured for payment.

BASIS OF PAYMENT

606-5.1 Payment shall be incidental to the installation of light fixtures and conduit.

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 C192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM D149	Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D5329	Standard Test Methods for Sealants and Fillers, Hot-applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements

END OF ITEM P-606

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Item P-610 Concrete for Miscellaneous Structures

DESCRIPTION

610-1.1 This item shall consist of concrete and reinforcement, as shown on the plans, prepared and constructed in accordance with these specifications. This specification shall be used for all concrete other than airfield pavement which are cast-in-place.

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 aggregate and coarse aggregates to be used in all concrete shall have been tested separately within six months of the project in accordance with ASTM C1260. Test results shall be submitted to the Engineer. The aggregate shall be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.08% at 14 days (16 days from casting). If the expansion either or both test specimen is greater than 0.08% at 14 days, but less than 0.20%, a minimum of 25% of Type F fly ash, or between 40% and 55% of slag cement shall be used in the concrete mix. If expansion of either the coarse or fine aggregate exceeds 0.08% at 14 days, limit the alkali of the concrete to be less than or equal to 3.0 lb per cubic yard (1.8 kg per cubic meter), calculated in accordance with EB 106.

If the expansion is greater than 0.20%, the aggregates shall not be used, and test results for other aggregates must be submitted for evaluation; or aggregates that meet P-501 reactivity test requirements may be utilized.

610-2.2 Coarse aggregate. The coarse aggregate for concrete shall meet the requirements of ASTM C33 and the requirements of Table 4, Class Designation 5S; and the grading requirements shown below, as required for the project.

Coarse Aggregate Grading Requirements

Maximum Aggregate Size	ASTM C33, Table 3 Grading Requirements (Size No.)
1 ½ inch (37.5 mm)	467, or 4 and 67
1 inch (25 mm)	57
¾ inch (19 mm)	67
½ inch (12.5 mm)	7

610-2.2.1 Coarse Aggregate susceptibility to durability (D) cracking. Section not used.

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

610-2.4 Cement. Cement shall conform to the requirements of ASTM C150 Type I, II, or III.

610-2.5 Cementitious materials.

a. 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 shall have a Calcium Oxide (CaO) content of less than 15% and a total available alkali content less than 3% per ASTM C311. Fly ash produced in furnace operations using liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the Engineer.

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall be used only at a rate between 25% and 55% of the total cementitious material by mass.

610-2.6 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.

610-2.7 Admixtures. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

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

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

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

610-2.8 Premolded joint material. Premolded joint material for expansion joints shall meet the requirements of ASTM D1751 or ASTM D1752.

610-2.9 Joint filler. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified.

610-2.10 Steel reinforcement. Reinforcing shall be shown on the plans and shall conform to the following requirements:

Steel Reinforcement

Welded Steel Wire Fabric	ASTM A1064, ASTM A884
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610-2.11 Materials for curing concrete. Curing materials shall conform to the following:

Materials for Curing

White-pigmented Liquid Membrane-Forming Compound, Type 2, Class B	ASTM C309
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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 Mixture. The concrete shall develop a compressive strength of 4000 psi in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cementitious material per cubic yard (280 kg per cubic meter). The water cementitious ratio shall not exceed 0.45 by weight. The air content of the concrete shall be 5% +/- 1.2% 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 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 or ASTM C685.

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 the Engineer's approval. If approval 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 is not permitted.

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

610-3.4 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.

610-3.5 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.

610-3.6 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.

610-3.7 Concrete Consistency. The Contractor shall monitor the consistency of the concrete delivered to the project site; collect each batch ticket; check temperature; and perform slump tests on each truck at the project site in accordance with ASTM C143.

610-3.8 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.

610-3.9 Vibration. Vibration shall follow the guidelines in American Concrete Institute (ACI) Committee 309R, Guide for Consolidation of Concrete.

610-3.10 Joints. Joints shall be constructed as indicated on the plans.

610-3.11 Finishing. 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.

610-3.12 Curing and protection. All concrete shall be properly cured in accordance with the recommendations in American Concrete Institute (ACI) 308R, Guide to External Curing of Concrete. The concrete shall be protected from damage until project acceptance.

610-3.13 Cold weather placing. When concrete is placed at temperatures below 40°F (4°C), follow the cold weather concreting recommendations found in ACI 306R, Cold Weather Concreting.

610-3.14 Hot weather placing. When concrete is placed in hot weather greater than 85°F (30 °C), follow the hot weather concreting recommendations found in ACI 305R, Hot Weather Concreting.

QUALITY ASSURANCE (QA)

610-4.1 Quality Assurance sampling and testing. Concrete for each day's placement will be accepted on the basis of the compressive strength specified in paragraph 610-3.2. The Engineer will sample the concrete in accordance with ASTM C172; test the slump in accordance with ASTM C143; test air content in accordance with ASTM C231; make and cure compressive strength specimens in accordance with ASTM C31; and test in accordance with ASTM C39. The QA testing agency will meet the requirements of ASTM C1077.

The Contractor shall provide adequate facilities for the initial curing of cylinders.

610-4.2 Defective work. Any defective work that cannot be satisfactorily repaired as determined by the Engineer, shall be removed and replaced at the Contractor's expense. Defective work includes, but is not limited to, uneven dimensions, honeycombing and other voids on the surface or edges of the concrete.

METHOD OF MEASUREMENT

610-5.1 Concrete for miscellaneous structures shall be considered incidental, and no separate measurement shall be made.

BASIS OF PAYMENT

610-6.1 Payment. Concrete for miscellaneous structures shall be considered incidental, and no separate payment shall be made.

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 A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
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 A884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
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 C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement 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 C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete

ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1157	Standard Performance Specification for Hydraulic Cement
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1365	Standard Test Method for Determination of the Proportion of Phases in Portland Cement and Portland-Cement Clinker Using X-Ray Powder Diffraction Analysis
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement 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
American Concrete Institute (ACI)	
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 308R	Guide to External Curing of Concrete
ACI 309R	Guide for Consolidation of Concrete

Federal Aviation Administration (FAA) Engineering Brief

EB 106	Guidance for the Implementation of Changes in Industry Cement Standard Specifications
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END OF ITEM P-610

Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer. The terms “paint” and “marking material” as well as “painting” and “application of markings” are interchangeable throughout this specification.

MATERIALS

620-2.1 Materials acceptance. The Contractor shall furnish manufacturer’s certified test reports, for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. 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 Engineer prior to the initial application of markings. The reports can be used for material acceptance or the Engineer may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the Engineer upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers that are easily quantifiable for inspection by the Engineer.

620-2.2 Marking materials.

Table 1. Marking Materials

Paint ¹				Glass Beads ²	
Type	Color	Fed Std. 595 Number	Application Rate Max.	Type	Application Rate Min.
Waterborne Type III	Yellow (Initial)	33538	180 ft ² /gal	--	--
Waterborne Type III	Yellow (Final)	33538	90 ft ² /gal	III	8 lb/gal
Waterborne Type III	Black (Final)	37038	90 ft ² /gal	--	--
Waterborne Type III	White (Initial)	37925	180 ft ² /gal	--	--
Waterborne Type III	White (Final)	37925	90 ft ² /gal	III	8 lb/gal

¹ See paragraph 620-2.2a.

² See paragraph 620-2.2b.

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 III. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

The acrylic resin used for Type III shall be 100% cross linking acrylic as evidenced by infrared peaks at wavelengths 1568, 1624, and 1672 cm⁻¹ with intensities equal to those produced by an acrylic resin known to be 100% cross linking.

b. Reflective media. Glass beads for white and yellow paint shall meet the requirements for Federal Specification TT-B-1325D Type III.

Glass beads for red and pink paint shall meet the requirements for Type IV, 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 and green paint.

Type III glass beads shall not be used in red and pink 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 paragraph 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 Engineer. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

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 Engineer 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 Engineer 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 Engineer. 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 manufacturer's application and surface preparation requirements must be submitted to the Engineer prior to the initial application of markings.

620-3.4 Layout of markings. The proposed markings shall be laid out in advance of the paint application. 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 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 Engineer.

The edges of the markings shall not vary from a straight line more than 1/2 inch (12 mm) in 50 feet (15 m), and marking dimensions and 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 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 bead shall not be hand thrown. 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 Engineer. 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) by the Contractor. A total of 6 readings 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 Engineer. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes and regulations.

METHOD OF MEASUREMENT

620-4.1a Surface preparation shall not be measured.

620-4.1b The quantity of markings shall be measured by the number of square feet of painting.

620-4.1c The quantity of reflective media shall be measured by lump sum.

620-4.1d Temporary markings not required.

BASIS OF PAYMENT

620-5.1 This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item complete in place and accepted by the Engineer in accordance with these specifications.

620-5.1a No payment shall be made for surface preparation. Surface preparation shall be incidental to markings.

620-5.1b Payment for markings shall be made at the contract price for the number of square feet of painting.

620-5.1c Payment for reflective media shall be made at the contract price per lump sum.

620-5.1d Temporary markings are not required.

Payment will be made under:

Item P-620-5.1b Marking (Type/Color) - per square foot

Item P-620-5.1c Reflective Media - per lump sum price

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 D476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
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 E303	Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester
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
Code of Federal Regulations (CFR)	
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	
Federal Specifications (FED SPEC)	
FED SPEC TT-B-1325D	Beads (Glass Spheres) Retro-Reflective
FED SPEC TT-P-1952F	Paint, Traffic and Airfield Marking, Waterborne
FED STD 595	Colors used in Government Procurement
Commercial Item Description	
A-A-2886B	Paint, Traffic, Solvent Based
Advisory Circulars (AC)	
AC 150/5340-1	Standards for Airport Markings
AC 150/5320-12	Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces

END OF ITEM P-620

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Item P-621 Saw-Cut Grooves

DESCRIPTION

621-1.1 This item consists of constructing saw-cut grooves to minimize hydroplaning during wet weather, providing a skid resistant surface in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer.

CONSTRUCTION METHODS

621-2.1 Procedures. The Contractor shall submit to the Engineer the grooving sequence and method of placing guide lines to control grooving operation. Transverse grooves saw-cut in the pavement must form a 1/4 inch (+1/16 inch, -0 inch) wide by 1/4 inch ($\pm 1/16$ inch) deep by 1-1/2 inch (-1/8 inch, +0 inch) center-to-center configuration. The grooves must be continuous for the entire runway length. They must be saw-cut transversely (perpendicular to centerline) in the runway and high-speed taxiway pavement to not less than 10 feet from the runway pavement edge to allow adequate space for equipment operation.

The saw-cut grooves must meet the following tolerances. The tolerances apply to each day's production and to each piece of grooving equipment used for production. The Contractor is responsible for all controls and process adjustments necessary to meet these tolerances. The Contractor shall routinely spot check for compliance each time the equipment aligns for a grooving pass.

a. Alignment tolerance. The grooves shall not vary more than $\pm 1/2$ inch in alignment for 75 feet along the runway length, allowing for realignment every 500 feet along the runway length.

b. Groove tolerance.

(1) Depth. The standard depth is 1/4 inch. At least 90% of the grooves must be at least 3/16 inch, at least 60% of the grooves must be at least 1/4 inch, and not more than 10% of the grooves may exceed 5/16 inch.

(2) Width. The standard width is 1/4 inch. At least 90% of the grooves must be at least 3/16 inch, at least 60% of the grooves must be at least 1/4 inch, and not more than 10% of the grooves may exceed 5/16 inch.

(3) Center-to-center spacing. The standard spacing is 1-1/2 inch. Minimum spacing 1-3/8 inch. Maximum spacing 1-1/2 inch.

Saw-cut grooves must not be closer than 3 inches or more than 9 inches from transverse joints in concrete pavements. Grooves must not be closer than 6 inches and no more than 18 inches from in-pavement light fixtures. Grooves may be continued through longitudinal construction joints. Where neoprene compression seals have been installed and the compression seals are recessed sufficiently to prevent damage from the grooving operation, grooves may be continued through the longitudinal joints. Where neoprene compression seals have been installed and the compression seals are not recessed sufficiently to prevent damage from the grooving operation, grooves must not be closer than 3 inches or more than 5 inches from the longitudinal joints. Where lighting cables are installed, grooving through longitudinal or diagonal saw kerfs shall not be allowed.

621-2.2 Environmental requirements. Grooving operations will not be permitted when freezing conditions prevent the immediate removal of debris and/or drainage of water from the grooved area. Discharge and disposal of waste slurry shall be the Contractor's responsibility.

621-2.3 Control strip. Groove a control strip in an area of the pavement outside of the trafficked area, as approved by the Engineer. The area shall be 50 feet long by two lanes wide. Demonstrate the setup and alignment process, the grooving operation, and the waste slurry disposal.

621-2.4 Existing pavements. Bumps, depressed areas, bad or faulted joints, and badly cracked and/or spalled areas in the pavement shall not be grooved until such areas are adequately repaired or replaced.

621-2.5 New pavements. New asphalt and Portland cement concrete pavements shall be allowed to cure for a minimum of 30 days before grooving, to allow the material to become stable enough to prevent closing of the grooves under normal use. If it can be demonstrated that grooves are stable, and can be installed with no spalling, tearing or raveling of the groove edge, grooving may occur sooner than 30 days with approval of the Engineer. All grade corrections must be completed prior to grooving. Spalling along or tearing or raveling of the groove edges shall not be allowed.

621-2.6 Grooving machine. Provide a grooving machine that is power driven, self-propelled, specifically designed and manufactured for pavement grooving, and has a self-contained and integrated continuous slurry vacuum system as the primary method for removing waste slurry. The grooving machine shall be equipped with diamond-saw cutting blades, and capable of making at least 18 inches in width of multiple parallel grooves in one pass of the machine. Thickness of the cutting blades shall be capable of making the required width and depth of grooves in one pass of the machine. The cutting head shall not contain a mixture of new and worn blades or blades of unequal wear or diameter. Match the blade type and configuration with the hardness of the existing airfield pavement. The wheels on the grooving machine shall be of a design that will not scar or spall the pavement. Provide the machine with devices to control depth of groove and alignment.

621-2.7 Water supply. Water for the grooving operation shall be provided by the Contractor.

621-2.8 Clean-up. During and after installation of saw-cut grooves, the Contractor must remove from the pavement all debris, waste, and by-products generated by the operations to the satisfaction of the Engineer. Cleanup of waste material must be continuous during the grooving operation. Flush debris produced by the machine to the edge of the grooved area or pick it up as it forms. The dust coating remaining shall be picked up or flushed to the edge of the area if the resultant accumulation is not detrimental to the vegetation or storm drainage system. Accomplish all flushing operations in a manner to prevent erosion on the shoulders or damage to vegetation. Waste material must be disposed of in an approved manner. Waste material must not be allowed to enter the airport storm sewer system. The Contractor must dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes and regulations.

621-2.9 Repair of damaged pavement. Grooving must be stopped and damaged pavement repaired at the Contractor's expense when directed by the Engineer.

621-2.10 Production rate. Section not used.

ACCEPTANCE

621-3.1 Acceptance testing. Grooves will be accepted based on results of zone testing. All acceptance testing necessary to determine conformance with the groove tolerances specified will be performed by the Engineer.

Instruments for measuring groove width and depth must have a range of at least 0.5 inch and a resolution of at least 0.005 inch. Gauge blocks or gauges machined to standard grooves width, depth, and spacing may be used.

Instruments for measuring center-to-center spacing must have a range of at least 3 inches and a resolution of at least 0.02 inch.

The Engineer will measure grooves in five zones across the pavement width. Measurements will be made at least three times during each day's production. Measurements in all zones will be made for each cutting head on each piece of grooving equipment used for each day's production.

The five zones are as follows:

Zone 1: Centerline to 5 feet left or right of the centerline.

Zone 2: 5 feet to 25 feet left of the centerline.

Zone 3: 5 feet to 25 feet right of the centerline.

Zone 4: 25 feet to edge of grooving left of the centerline.

Zone 5: 25 feet to edge of grooving right of the centerline.

At a random location within each zone, five consecutive grooves sawed by each cutting head on each piece of grooving equipment will be measured for width, depth, and spacing. The five consecutive measurements must be located about the middle blade of each cutting head ± 4 inches. Measurements will be made along a line perpendicular to the grooves.

- Width or depth measurements less than 0.170 inch shall be considered less than 3/16 inch.
- Width or depth measurements more than 0.330 inch shall be considered more than 5/16 inch.
- Width or depth measurements more than 0.235 inch shall be considered more than 1/4 inch.

Production must be adjusted when more than one groove on a cutting head fails to meet the standard depth, width, or spacing in more than one zone.

METHOD OF MEASUREMENT

621-4.1 The quantity of grooving to be paid for shall be the number of square yards of grooving performed in accordance with the specifications and accepted by the Engineer per paragraph 621-3.1.

BASIS OF PAYMENT

621-5.1 Payment for saw-cut grooving. Payment for saw-cut grooving will be made at the contract unit price per square yard for saw-cut grooving. This price shall be full compensation for furnishing all materials, and for all preparation, delivering, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-621-5.1 Grooving - 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.

Advisory Circulars (AC)

AC 150/5320-12	Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces
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END OF ITEM P-621

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Part 12 – Turfing

Item T-901 Seeding

DESCRIPTION

901-1.1 This item shall consist of soil preparation, seeding and fertilizing the areas shown on the plans or as directed by the Engineer in accordance with these specifications.

MATERIALS

901-2.1 Seed. The species and application rates of grass, legume, and cover-crop seed furnished shall be those stipulated herein. Seed shall conform to the requirements of Federal Specification JJJ-S-181, Federal Specification, Seeds, Agricultural.

Seed shall be furnished separately or in mixtures in standard containers labeled in conformance with the Agricultural Marketing Service (AMS) Seed Act and applicable state seed laws with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Engineer duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within six (6) months of date of delivery. This statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed. Wet, moldy, or otherwise damaged seed will be rejected.

Seeds shall be applied as follows:

Seed Properties and Rate of Application

Seed	Minimum Seed Purity (Percent)	Minimum Germination (Percent)	Rate of Application lb/acre (or lb/1,000 S.F.)
As identified on the plans.			

Seeding shall be performed during the period between March 15 to May 1 and August 15 to October 1 inclusive, unless otherwise approved by the Engineer.

901-2.2 Lime. Not required.

901-2.3 Fertilizer. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

- a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
- b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or

- c. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be a commercial fertilizer as indicated in the plans and shall be spread at the rate as shown on the plans.

901-2.4 Soil for repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the Engineer before being placed.

CONSTRUCTION METHODS

901-3.1 Advance preparation and cleanup. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than 2 inches (50 mm) in any diameter, sticks, stumps, and other debris that might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage include filling gullies, smoothing irregularities, and repairing other incidental damage.

An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches (125 mm) as a result of grading operations and, if immediately prior to seeding, the top 3 inches (75 mm) of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

When the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches (125 mm). Clods shall be broken and the top 3 inches (75 mm) of soil shall be worked into a satisfactory seedbed by discing, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

901-3.2 Dry application method. Section not used.

901-3.3 Wet application method.

a. General. The Contractor may elect to apply seed and fertilizer (and lime, if required) by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.

b. Spraying equipment. The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons (190 liters) over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering 100 gallons (380 liters) per minute at a pressure of 100 lb / sq inches (690 kPa). The pump shall be mounted in a line that will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipe lines shall be capable of providing clearance for 5/8 inch (16 mm) solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from 20 to 100 feet (6 to 30 m). One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet (15 m) in length shall be provided to which the nozzles may be connected.

c. Mixtures. Lime, if required, shall be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds (100 kg) of lime shall be added to and mixed with each 100 gallons (380 liters) of water. Seed and fertilizer shall be mixed together in the relative proportions specified, but not more than a total of 220 pounds (100 kg) of these combined solids shall be added to and mixed with each 100 gallons (380 liters) of water.

All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. The Contractor shall identify to the Engineer all sources of water at least two (2) weeks prior to use. The Engineer may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source that is disapproved by the Engineer following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within two (2) hours from the time they were mixed or they shall be wasted and disposed of at approved locations.

d. Spraying. Lime, if required, shall be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime shall be worked into the top 3 inches (75 mm), after which the seedbed shall again be properly graded and dressed to a smooth finish.

Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray that shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area.

Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces that are to be mulched as indicated by the plans or designated by the Engineer, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

901-3.4 Maintenance of seeded areas. The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Engineer. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow,

water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work.

When either the dry or wet application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the Engineer. A grass stand shall be considered adequate when bare spots are one square foot (0.01 sq m) or less, randomly dispersed, and do not exceed 3% of the area seeded.

METHOD OF MEASUREMENT

901-4.1 The quantity of seeding to be paid for shall be the number of acres measured on the ground surface, completed and accepted.

BASIS OF PAYMENT

901-5.1 Payment shall be made at the contract unit price per acre or fraction thereof, which price and payment shall be full compensation for furnishing and placing all material and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

Payment will be made under:

Item 901-5.1 Seeding - per acre

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 C602 Standard Specification for Agricultural Liming Materials

Federal Specifications (FED SPEC)

FED SPEC JJJ-S-181, Federal Specification, Seeds, Agricultural

Advisory Circulars (AC)

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

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-901

Item T-905 Topsoil

DESCRIPTION

905-1.1 This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the Engineer.

MATERIALS

905-2.1 Topsoil. Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches (50 mm) or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means, shall be removed. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh (75 μ m) sieve as determined by the wash test in accordance with ASTM C117.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

905-2.2 Inspection and tests. Within 10 days following acceptance of the bid, the Engineer shall be notified of the source of topsoil to be furnished by the Contractor. The topsoil shall be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. At this time, the Contractor may be required to take representative soil samples from several locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in paragraph 905-2.1.

CONSTRUCTION METHODS

905-3.1 General. Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the Engineer before the various operations are started.

905-3.2 Preparing the ground surface. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the Engineer, to a minimum depth of 2 inches (50 mm) to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches (50 mm) in any diameter and all litter or other material which may be detrimental to proper bonding, the rise

of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and compacted condition to prevent the formation of low places or pockets where water will stand.

905-3.3 Obtaining topsoil. Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the Engineer. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as directed by the Engineer. The topsoil shall be spread on areas already tilled and smooth-graded or stockpiled in areas approved by the Engineer. Any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoil purposes, shall be removed, and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the airport site, the Contractor shall locate and obtain the supply, subject to the approval of the Engineer. The Contractor shall notify the Engineer sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

905-3.4 Placing topsoil. The topsoil shall be evenly spread on the prepared areas to a uniform depth of 2 inches (50 mm) after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches (50 mm) or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the Engineer. The compacted topsoil surface shall conform to the required lines, grades, and cross-sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

METHOD OF MEASUREMENT

905-4.1 Section not used.

905-4.2 Topsoil obtained off the site shall be measured by the number of cubic yards (cubic meters).

BASIS OF PAYMENT

905-5.1 Section not used

905-5.2 Payment will be made at the contract unit price per cubic yard (cubic meter) for topsoil (obtained off the site). This price shall be full compensation for furnishing all materials and for all preparation,

placing, and spreading of the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-905-5.2 Topsoil (Furnished from Off the Site) - per cubic yard (cubic meter)

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 C117 Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing

Advisory Circulars (AC)

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

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-905

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Item T-908 Mulching

DESCRIPTION

908-1.1 This item shall consist of furnishing, hauling, placing, and securing mulch on surfaces indicated on the plans or designated by the Engineer.

MATERIALS

908-2.1 Mulch material. Acceptable mulch shall be the materials listed below or any approved locally available material that is similar to those specified. Mulch shall be free from noxious weeds, mold, and other deleterious materials. Mulch materials, which contain matured seed of species that would volunteer and be detrimental to the proposed overseeding, or to surrounding farm land, will not be acceptable. Straw or other mulch material which is fresh and/or excessively brittle, or which is in such an advanced stage of decomposition as to smother or retard the planted grass, will not be acceptable.

a. Hay. Not used.

b. Straw. Not used.

c. Hay mulch containing seed. Not used.

d. Manufactured mulch. Cellulose-fiber or wood-pulp mulch shall be products commercially available for use in spray applications.

e. Asphalt binder. Not used.

908-2.2 Inspection. The Engineer shall be notified of sources and quantities of mulch materials available, and the Contractor shall furnish him with representative samples of the materials to be used 30 days before delivery to the project. These samples may be used as standards with the approval of the Engineer and any materials brought on the site that do not meet these standards shall be rejected.

CONSTRUCTION METHODS

908-3.1 Mulching. Before spreading mulch, all large clods, stumps, stones, brush, roots, and other foreign material shall be removed from the area to be mulched. Mulch shall be applied immediately after seeding. The spreading of the mulch may be by hand methods, blower, or other mechanical methods, provided a uniform covering is obtained.

Mulch material shall be furnished, hauled, and evenly applied on the area shown on the plans or designated by the Engineer. ~~Straw or hay shall be spread over the surface to a uniform thickness at the rate of 2 to 3 tons per acre (1800—2700 kg per acre) to provide a loose depth of not less than 1 1/2 inches (38 cm) nor more than 3 inches (75 mm).~~ Other organic material shall be spread at the rate directed by the Engineer. ~~Mulch may be blown on the slopes and the use of cutters in the equipment for this purpose will be permitted to the extent that at least 95% of the mulch in place on the slope shall be 6 inches (150 mm) or more in length. When mulches applied by the blowing method are cut, the loose depth in place shall be not less than one inch (25 mm) nor more than 2 inches (50 mm).~~

908-3.2 Securing mulch. The mulch shall be held in place by light discing, a very thin covering of topsoil, pins, stakes, wire mesh, asphalt binder, or other adhesive material approved by the Engineer. ~~Where mulches have been secured by either of the asphalt binder methods, it will not be permissible to~~

~~walk on the slopes after the binder has been applied. When an application of asphalt binder material is used to secure the mulch, the Contractor must take every precaution to guard against damaging or disfiguring structures or property on or adjacent to the areas worked and will be held responsible for any such damage resulting from the operation.~~

~~If the “peg and string” method is used, the mulch shall be secured by the use of stakes or wire pins driven into the ground on 5 foot (1.5 m) centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be firmly driven nearly flush to the ground to draw the twine down tight onto the mulch.~~

908-3.3 Care and repair.

a. The Contractor shall care for the mulched areas until final acceptance of the project. Care shall consist of providing protection against traffic or other use by placing warning signs, as approved by the Engineer, and erecting any barricades that may be shown on the plans before or immediately after mulching has been completed on the designated areas.

b. The Contractor shall be required to repair or replace any mulch that is defective or becomes damaged until the project is finally accepted. When, in the judgment of the Engineer, such defects or damages are the result of poor workmanship or failure to meet the requirements of the specifications, the cost of the necessary repairs or replacement shall be borne by the Contractor.

~~c. If the “asphalt spray” method is used, all mulched surfaces shall be sprayed with asphalt binder material so that the surface has a uniform appearance. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons (32 liters) per 1,000 square feet (100 sq m), or as directed by the Engineer, with a minimum of 6 gallons (24 liters) and a maximum of 10 gallons (40 liters) per 1,000 square feet (100 sq m) depending on the type of mulch and the effectiveness of the binder securing it. Asphalt binder material may be sprayed on the mulched slope areas from either the top or the bottom of the slope. An approved spray nozzle shall be used. The nozzle shall be operated at a distance of not less than 4 feet (1.2 m) from the surface of the mulch and uniform distribution of the asphalt material shall be required. A pump or an air compressor of adequate capacity shall be used to ensure uniform distribution of the asphalt material.~~

~~d. If the “asphalt mix” method is used, the mulch shall be applied by blowing, and the asphalt binder material shall be sprayed into the mulch as it leaves the blower. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons (32 liters) per 1,000 square feet (100 sq m) or as directed by the Engineer, with a minimum of 6 gallons (24 liters) and a maximum of 10 gallons (40 liters) per 1,000 square feet (100 sq m) depending on the type of mulch and the effectiveness of the binder securing it.~~

METHOD OF MEASUREMENT

908-4.1 Mulching shall be measured in acres on the basis of the actual surface area acceptably mulched.

BASIS OF PAYMENT

908-5.1 Payment will be made at the contract unit price per acre for mulching. The price shall be full compensation for furnishing all materials and for placing and anchoring the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-908-5.1 Mulching – per acre

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 D977 Standard Specification for Emulsified Asphalt

Advisory Circulars (AC)

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

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-908

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Part 13 – Lighting Installation

Item L-108 Underground Power Cable for Airports

DESCRIPTION

108-1.1 This item shall consist of furnishing and installing power cables that are direct buried and furnishing and/or installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. It includes excavation and backfill of trench for direct-buried cables only. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the Engineer. This item shall not include the installation of duct banks or conduit, trenching and backfilling for duct banks or conduit, or furnishing or installation of cable for FAA owned/operated facilities.

EQUIPMENT AND MATERIALS

108-2.1 General.

- a.** Airport lighting equipment and materials covered by advisory circulars (AC) shall be approved under the Airport Lighting Equipment Certification Program per AC 150/5345-53, current version.
- b.** All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the Engineer.
- c.** Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications at the Contractor's cost.
- d.** All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.
- e.** The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be electronically submitted in pdf format. The Engineer reserves the right to reject any and all equipment, materials, or procedures that do not meet the system design and the standards and codes, specified in this document.
- f.** All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of final acceptance by

the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. The Contractor shall 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, 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 feet long and 3/4 inch 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. A cast splice, employing a plastic mold and using epoxy resin equivalent to that manufactured by 3M™ Company, "Scotchcast" Kit No. 82-B, or an approved equivalent, used for potting the splice is acceptable.

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 Engineer proof of the qualifications of each proposed cable splicer for the airport cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

108-2.6 Concrete. Concrete shall be 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 Scotch™ Electrical Tapes – Scotch™ 88 (1-1/2 inch (38 mm) wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch (50 mm) wide) – as manufactured by the Minnesota Mining and Manufacturing Company (3M™), or an approved equivalent.

108-2.10 Electrical coating. Electrical coating shall be Scotchkote™ as manufactured by 3M™, or an approved equivalent.

108-2.11 Existing circuits. Whenever the scope of work requires connection to an existing circuit, the existing circuit's insulation resistance shall be tested, in the presence of the Engineer. The test shall be performed per this item and prior to any activity that will affect the respective circuit. The Contractor shall record the results on forms acceptable to the Engineer. When the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, in the presence of the Engineer. The Contractor shall record the results on forms acceptable to the Engineer. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the 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 Engineer or shown on the plans.

In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points shall be installed at locations shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed 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 Engineer.

Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans.

108-3.2 Installation in duct banks or conduits. This item includes the installation of the cable in duct banks or conduit per the following paragraphs. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

The Contractor shall make no connections or splices of any kind in cables installed in conduits or duct banks.

Unless otherwise designated in the plans, where ducts are in tiers, use the lowest ducts to receive the cable first, with spare ducts left in the upper levels. Check duct routes prior to construction to obtain assurance that the shortest routes are selected and that any potential interference is avoided.

Duct banks or conduits shall be installed as a separate item per Item L-110, Airport Underground Electrical Duct Banks and Conduit. The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to ensure that the duct bank or conduit is open, continuous and clear of debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, light bases, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be re-cleaned at the Contractor's expense. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the Engineer of any blockage in the existing ducts.

The cable shall be installed in a manner that prevents harmful stretching of the conductor, damage to the insulation, or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape providing moisture-tight mechanical protection with minimum bulk, or alternately, heat shrinkable tubing before pulling into the conduit and it shall be left sealed until connections are made. Where more than one cable is to be installed in a conduit, all cable shall be pulled in the conduit at the same time. The pulling of a cable through duct banks or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Maximum pulling tensions shall not exceed the cable manufacturer's recommendations. A non-hardening cable-pulling lubricant recommended for the type of cable being installed shall be used where required.

The Contractor shall submit the recommended pulling tension values to the Engineer prior to any cable installation. If required by the Engineer, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the Engineer. Cable pull tensions shall be recorded by the Contractor and reviewed by the Engineer. Cables exceeding the maximum allowable pulling tension values shall be removed and replaced by the Contractor at the Contractor's expense.

The manufacturer's minimum bend radius or NEC requirements (whichever is more restrictive) shall apply. Cable installation, handling and storage shall be per manufacturer's recommendations. During cold weather, particular attention shall be paid to the manufacturer's minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the Engineer, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

Cable shall not be dragged across base can or manhole edges, pavement or earth. When cable must be coiled, lay cable out on a canvas tarp or use other appropriate means to prevent abrasion to the cable jacket.

108-3.3 Installation of direct-buried cable in trenches. Unless otherwise specified, the Contractor shall not use a cable plow for installing the cable. Cable shall be unreeled uniformly in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one end. Slack cable sufficient to provide strain relief shall be placed in the trench in a series of S curves. Sharp bends or kinks in the cable shall not be permitted.

Where cables must cross over each other, a minimum of 3 inches (75 mm) vertical displacement shall be provided with the topmost cable depth at or below the minimum required depth below finished grade.

a. Trenching. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored. Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of surface is disturbed. Graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 18 inches (0.5 m) below finished grade per NEC Table 300.5, except as follows:

- When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches (91 cm) unless otherwise specified.
- Minimum cable depth when crossing under a railroad track, shall be 42 inches (1 m) unless otherwise specified.

The Contractor shall excavate all cable trenches to a width not less than 6 inches (150 mm). Unless otherwise specified on the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. Flowable backfill material may alternatively be used.

Duct bank or conduit markers temporarily removed for trench excavations shall be replaced as required.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

(1) Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred.

(2) Trenching, etc., in cable areas shall then proceed, with approval of the Engineer, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair or replacement.

b. Backfilling. After the cable has been installed, the trench shall be backfilled. The first layer of backfill in the trench shall encompass all cables ; be 3 inches (75 mm) deep, loose measurement; and shall be either earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. This layer shall not be compacted. The second layer shall be 5 inches (125 mm) deep, loose measurement, and shall contain no particles that would be retained on a one inch (25.0 mm) sieve. The remaining third and subsequent layers of backfill shall not exceed 8 inches (20 cm) of loose measurement and be excavated or imported material and shall not contain stone or aggregate larger than 4 inches (100 mm) maximum diameter.

The second and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent material. If the cable is to be installed in locations or areas where other compaction requirements are specified (under pavements, embankments, etc.), the backfill compaction shall be to a minimum of 100 percent of ASTM D1557.

Trenches shall not contain pools of water during backfilling operations. The trench shall be completely backfilled and tamped level with the adjacent surface, except that when turf is to be established over the trench, the backfilling shall be stopped at an appropriate depth consistent with the type of turfing operation to be accommodated. A proper allowance for settlement shall also be provided. Any excess excavated material shall be removed and disposed of per the plans and specifications.

Underground electrical warning (caution) tape shall be installed in the trench above all direct-buried cable. Contractor shall submit a sample of the proposed warning tape for acceptance by the Engineer. If not shown on the plans, the warning tape shall be located 6 inches (150 mm) above the direct-buried cable or the counterpoise wire if present. A 3-6 inch (75 - 150 mm) wide polyethylene film detectable tape, with a metalized foil core, shall be installed above all direct buried cable or counterpoise. The tape shall be of the color and have a continuous legend as indicated on the plans. The tape shall be installed 8 inches (200 mm) minimum below finished grade.

c. Restoration. Following restoration of all trenching near airport movement surfaces, the Contractor shall visually inspect the area for foreign object debris (FOD) and remove any that is found. Where soil and sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by work shall be restored to its original condition. The restoration shall include the topsoiling, fertilizing, seeding, and mulching as shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. When trenching is through paved areas, restoration shall be equal to existing conditions. If the cable is to be installed in locations or areas where other compaction requirements are specified (under pavements, embankments, etc.) the backfill compaction shall be to a minimum of 100 percent of ASTM D1557. Restoration shall be considered incidental to the pay item of which it is a component part.

108-3.4 Cable markers for direct-buried cable. The location of direct buried circuits shall be marked by a concrete slab marker, 2 feet (60 cm) square and 4-6 inch (10 - 15 cm) thick, extending approximately one inch (25 mm) above the surface. Each cable run from a line of lights and signs to the equipment vault shall be marked at approximately every 200 feet (61 m) along the cable run, with an additional marker at each change of direction of cable run. All other direct-buried cable shall be marked in the same manner. Cable markers shall be installed directly above the cable. The Contractor shall impress the word "CABLE" and directional arrows on each cable marking slab. The letters shall be approximately 4 inches (100 mm) high and 3 inches (75 mm) wide, with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep. Stencils shall be used for cable marker lettering; no hand lettering shall be permitted.

At the location of each underground cable connection/splice, except at lighting units, or isolation transformers, a concrete marker slab shall be installed to mark the location of the connection/splice. The Contractor shall impress the word "SPICE" on each slab. The Contractor also shall impress additional circuit identification symbols on each slab as directed by the Engineer. All cable markers and splice markers shall be painted international orange. Paint shall be specifically manufactured for uncured exterior concrete. After placement, all cable or splice markers shall be given one coat of high-visibility aviation orange paint as approved by the Engineer. Furnishing and installation of cable markers is incidental to the respective cable pay item.

108-3.5 Splicing. Connections of the type shown on the plans shall be made by experienced personnel regularly engaged in this type of work and shall be made as follows:

a. Cast splices. These shall be made by using crimp connectors for jointing conductors. Molds shall be assembled, and the compound shall be mixed and poured per the manufacturer's instructions and to the satisfaction of the Engineer.

b. Field-attached plug-in splices. These shall be assembled per the manufacturer's instructions. These splices shall be made by plugging directly into mating connectors. 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 Engineer 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. Section 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.

108-3.7 Counterpoise installation above multiple conduits and duct banks. Counterpoise wires shall be installed above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete area of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits shall be adequate to provide a complete 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.

108-3.8 Counterpoise installation at existing duct banks. When airfield lighting cables are indicated on the plans to be routed through existing duct banks, the new counterpoise wiring shall be terminated at ground rods at each end of the existing duct bank where the cables being protected enter and exit the duct bank. The new counterpoise conductor shall be bonded to the existing counterpoise system.

108-3.9 Exothermic bonding. Bonding of counterpoise wire shall be by the exothermic welding process or equivalent method accepted by the Engineer. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the Engineer, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

a. All slag shall be removed from welds.

b. Using an exothermic weld to bond the counterpoise to a lug on a galvanized light base is not recommended unless the base has been specially modified. Consult the manufacturer's installation directions for proper methods of bonding copper wire to the light base. See AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.10 Testing. The Contractor shall furnish all necessary equipment and appliances for testing the airport electrical systems and underground cable circuits before and after installation. The Contractor shall perform all tests in the presence of the Engineer. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the Engineer. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

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

b. Should the counterpoise or ground grid conductors be damaged or suspected of being damaged by construction activities the Contractor shall test the conductors for continuity with a low resistance ohmmeter. The conductors shall be isolated such that no parallel path exists and tested for continuity. The

Engineer shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

After installation, the Contractor shall test and demonstrate to the satisfaction of the Engineer the following:

- c. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.
- d. That all affected circuits (existing and new) are free from unspecified grounds.
- e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than 50 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 Engineer prior to performing the testing.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the Engineer. Where connecting new cable to existing cable, 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 The cost of all excavation, backfill, dewatering and restoration regardless of the type of material encountered shall be included in the unit price bid for the work.

108-4.2 Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet installed and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. The measurement for this item shall not include additional quantities required for slack. Cable and counterpoise slack is considered incidental to this item and is included in the Contractor's unit price. No separate measurement or payment will be made for cable or counterpoise slack.

108-4.3 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 Engineer. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

Payment will be made under:

Item L-108-5.2 No. 8 AWG, 5 kV, L-824, Type C Cable, Installed in Trench, Duct Bank or Conduit - per liner foot

Item L-108-5.3 No. 6 AWG, Solid, Bare Copper Counterpoise Wire, Installed in Trench, 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

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Item L-109 Airport Transformer Vault and Vault Equipment

DESCRIPTION

109-1.1 This item shall consist of modifying the constructing an airport transformer vault, or a prefabricated metal housing per these specifications and per the design and dimensions shown in the plans. This work shall also include the installation of conduits, and in the floor and foundation, painting and lighting of the vault or metal housing, and the furnishing of all incidentals that are necessary to produce a completed unit. Included as a separate part under this item or as a separate item where an existing vault is to be used shall be the furnishing of all vault equipment, wiring, electrical buses, cable, conduit, potheads, and grounding systems. This work shall also include the painting of equipment and conduit; the marking and labeling of equipment and the labeling or tagging of wires; the testing of the installation; and the furnishing of all incidentals necessary to place it in operating condition as a completed unit to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

109-2.1 General.

a. Airport lighting equipment and materials covered by advisory circulars (AC) shall be certified in AC 150/5345-53, Airport Lighting Equipment Certification Program (ALECP) and listed in the ALECP Addendum.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be provided in electronic pdf format, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes, specified in this document.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by

the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

CONSTRUCTION OF VAULT AND PREFABRICATED METAL HOUSING

109-3.1 Electrical vault building. Section not used.

109-3.2 Concrete. Section not used.

109-3.3 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. Precast concrete structures shall conform to ASTM C478.

109-3.4 Reinforcing steel. Reinforcing steel bars shall be intermediate or structural grade deformed-type bars and shall be per ASTM A615.

109-3.5 Brick. Brick shall be per ASTM C62, Grade SW.

109-3.6 Rigid steel conduit. Rigid steel conduit and fittings shall be per Underwriters Laboratories Standards 6 and 514B.

109-3.7 Plastic Conduit and fittings. Plastic Conduit and fittings shall conform to the requirements of UL-651 and UL-654 schedule 40 polyvinyl chloride (PVC) suitable for use above or below ground.

109-3.8 Lighting. Vault or metal-housing light fixtures shall be of a vapor-proof type.

109-3.9 Outlets. Convenience outlets shall be heavy-duty duplex units designed for industrial service.

109-3.10 Switches. Vault or metal-housing light switches shall be single-pole switches.

109-3.11 Paint.

a. Priming paint for non-galvanized metal surfaces shall be a high solids alkyd primer compatible with the manufacturer's recommendations for the intermediate or topcoat.

b. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the Master Painter's Institute (MPI), Reference #9, Exterior Alkyd, Gloss.

c. Priming paint for wood surfaces shall be mixed on the job by thinning the specified white paint by adding 1/2 pint (0.24 liter) of raw linseed oil to each gallon (liter).

d. Paint for the floor, ceiling, and inside walls shall be per Porter Paint Company 69, 71, and 79 or equivalent. Walls and ceiling shall be light gray and the floor shall be medium gray.

e. The roof coating shall be hot asphalt material per ASTM D2823. Asbestos-free roof coating per ASTM D4479 may be substituted if required by local codes.

109-3.12 Ground bus. Ground bus shall be 1/8 × 3/4 inch (3 × 19 mm) minimum copper bus bar.

109-3.13 Square duct. Duct shall be square similar to that manufactured by the Square D Company (or equivalent), or the Trumbull Electric Manufacturing Company (or equivalent). The entire front of the duct on each section shall consist of hinged or removable cover for ready access to the interior. The cross-section of the duct shall be not less than 4 × 4 inch (100 × 100 mm) except where otherwise shown in the plans.

109-3.14 Ground rods. Ground rods shall be in accordance with Item L-108.

109-3.15 Vault prefabricated metal housing. Section not used.

109-3.16 FAA-approved equipment. Certain items of airport lighting equipment installed in vaults are covered by individual ACs listed below:

AC 150/5345-3	Specification for L-821, Panels for Remote Control of Airport Lighting
AC 150/5345-5	Circuit Selector Switch
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-10	Specification for Constant Current Regulators and Regulator Monitors
AC 150/5345-13	Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits
AC 150/5345-49	Specification for L-854, Radio Control Equipment
AC 150/5345-56	Specification for L-890 Airport Lighting Control and Monitoring System (ALCMS)

109-3.17 Other electrical equipment. Distribution transformers, oil switches, cutouts, relays, terminal blocks, transfer relays, circuit breakers, and all other regularly used commercial items of electrical equipment not covered by FAA equipment specifications and ACs 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 proposal and plans. Equipment selected and installed by the Contractor shall maintain the interrupting current rating of the existing systems or specified rating whichever is greater.

109-3.18 Wire. Wire (in conduit) rated up to 5,000 volts shall be per AC 150/5345-7, Specification for L-824 Underground Electrical Cables for Airport Lighting Circuits. For ratings up to 600 volts, moisture and heat resistant thermoplastic wire conforming to Commercial Item Description A-A-59544A Type THWN-2 shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

a. Control circuits. Unless otherwise indicated on the plans, wire shall be not less than No. 12 American wire gauge (AWG) and shall be insulated for 600 volts. If telephone control cable is specified, No. 19 AWG telephone cable per ANSI/Insulated Cable Engineers Association (ICEA) S-85-625 specifications shall be used.

b. Power circuits.

- (1) 600 volts maximum – Wire shall be No. 6 AWG or larger and insulated for at least 600 volts.
- (2) 3,000 volts maximum – Wire shall be No. 6 AWG or larger and insulated for at least 3,000 volts.
- (3) Over 3,000 volts – Wire shall be No. 6 AWG or larger and insulated for at least the circuit voltage.

109-3.19 Short circuit / coordination / device evaluation / arc flash analysis. The Contractor shall, based upon the equipment provided, include as a part of the submittal process the electrical system “Short Circuit / Coordination / Device evaluation / Arc Flash Analysis.” The analysis shall be performed by the equipment manufacturer and submitted in a written report. The analysis shall be signed and sealed by a registered professional Engineer from the state in which the project is located. The analysis shall comply with NFPA-70E and IEEE 1584.

The analysis will include one line diagrams, short circuit analysis, coordination analysis, equipment evaluation, arc flash analysis and arc flash labels containing at a minimum, equipment name, voltage/current rating, available incident energy and flash protection boundary.

The selected firms field service Engineer shall perform data gathering for analysis completion and device settings, perform device setting as recommended by the analysis and will furnish and install the arc flash labels. The components worst case incident energy will be considered the available arc flash energy at that specific point in the system. Submit three written copies and one electronic copy of the report.

CONSTRUCTION METHODS

CONSTRUCTION OF VAULT AND PREFABRICATED METAL HOUSING

109-4.1 General. Section not used.

109-4.2 Foundation and walls. Section not used.

109-4.3 Roof. Section not used.

109-4.4 Floor. Section not used.

109-4.5 Floor drain. Section not used.

109-4.6 Conduits in floor and foundation. Conduits shall be installed in the floor and through the foundation walls per the details shown in the plans. All underground conduit shall be painted with an asphalt compound. Conduit shall be installed with a coupling or metal conduit adapter flush with the top of the floor. All incoming conduit shall be closed with a pipe plug to prevent the entrance of foreign material during construction. Space conduit entrances shall be left closed.

109-4.7 Doors. Section not used.

109-4.8 Painting. Section not used.

109-4.9 Lights and switches. Section not used.

INSTALLATION OF EQUIPMENT IN VAULT OR PREFABRICATED METAL HOUSING

109-5.1 General. The Contractor shall furnish, install, and connect all equipment, equipment accessories, conduit, cables, wires, buses, grounds, and support necessary to ensure a complete and operable electrical distribution center for the airport lighting system as specified herein and shown in the plans. When specified, an emergency power supply and transfer switch shall be provided and installed.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and local code agency having jurisdiction. All electrical work shall comply with the NEC and local code agency having jurisdiction including the separation of under 600V work from 5,000V work.

109-5.2 Power supply equipment. Transformers, regulators, booster transformers, and other power supply equipment items shall be furnished and installed at the location shown in the plans or as directed by the Engineer. The power supply equipment shall be set on steel "H" sections, "I" beams, channels, or concrete blocks to provide a minimum space of 1-1/2 inch (38 mm) between the equipment and the floor. The equipment shall be placed so as not to obstruct the oil-sampling plugs of the oil-filled units; and name-plates shall, so far as possible, not be obscured.

If specified in the plans and specifications, equipment for an alternate power source or an emergency power generator shall be furnished and installed. The alternate power supply installation shall include all equipment, accessories, an automatic changeover switch, and all necessary wiring and connections. The emergency power generator set shall be the size and type specified.

109-5.3 Switchgear and panels. Oil switches, fused cutouts, relays, transfer switches, panels, panel boards, and other similar items shall be furnished and installed at the location shown in the plans or as directed by the Engineer. Wall or ceiling mounted items shall be attached to the wall or ceiling with galvanized bolts of not less than 3/8-inch (9 mm) diameter engaging metal expansion shields or anchors in masonry or concrete vaults.

109-5.4 Duct and conduit. The Contractor shall furnish and install square-type exposed metallic ducts with hinged covers for the control circuits in the vault. These shall be mounted along the walls behind all floor-mounted equipment and immediately below all wall-mounted equipment. The hinged covers shall be placed to open from the front side with the hinges at the front bottom.

Wall brackets for square ducts shall be installed at all joints 2 feet (60 cm) or more apart with intermediate brackets as specified. Conduit shall be used between square ducts and equipment or between different items of equipment when the equipment is designed for conduit connection. When the equipment is not designed for conduit connection, conductors shall enter the square-type control duct through insulating bushings in the duct or on the conduit risers.

109-5.5 Wiring and connections. The Contractor shall make all necessary electrical connections in the vault per the wiring diagrams furnished and as directed by the Engineer. In wiring to the terminal blocks, the Contractor shall leave sufficient extra length on each control lead to make future changes in connections at the terminal block. This shall be accomplished by running each control lead the longest way around the box to the proper terminal. Leads shall be neatly laced in place.

109-5.6 Marking and labeling. All equipment, control wires, terminal blocks, etc., shall be tagged, marked, or labeled as specified below:

a. Wire identification. The Contractor shall furnish and install self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks. Wire labels, if used, shall be of the self-sticking preprinted type and of the manufacturer's recommended size for the wire involved. Identification markings designated in the plans shall be followed. Tags, if used, shall be of fiber not less than 3/4 inch (19 mm) in diameter and not less than 1/32 inch (1 mm) thick. Identification markings designated in the plans shall be stamped on tags by means of small tool dies. Each tag shall be securely tied to the proper wire by a nonmetallic cord.

b. Labels. The Contractor shall stencil identifying labels on the cases of regulators, breakers, and distribution and control relay cases with white oil paint as designated by the Engineer. The letters and numerals shall be not less than one inch (25 mm) in height and shall be of proportionate width. The Contractor shall also mark the correct circuit designations per the wiring diagram on the terminal marking strips, which are a part of each terminal block.

METHOD OF MEASUREMENT

109-6.1 Section not used.

109-6.2 Section not used.

109-6.3 The quantity of equipment to be paid for under this item shall consist of all equipment installed, connected and accepted as a complete unit ready for operation within an existing vault or prefabricated metal housing.

BASIS OF PAYMENT

109-7.1 Payment will be made at the contract unit price for each completed and accepted vault or prefabricated metal housing equipment installation. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item L-109-7.4 Installation of Equipment within existing vault or prefabricated metal housing in Place - per unit

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 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-3	Specification for L-821, Panels for Remote Control of Airport Lighting
AC 150/5345-5	Circuit Selector Switch
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-10	Specification for Constant Current Regulators and Regulator Monitors
AC 150/5345-13	Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits
AC 150/5345-49	Specification L-854, Radio Control Equipment
AC 150/5345-53	Airport Lighting Equipment Certification Program

American National Standards Institute / Insulated Cable Engineers Association (ANSI/ICEA)

ANSI/ICEA S-85-625	Standard for Telecommunications Cable Aircore, Polyolefin Insulated, Copper Conductor Technical Requirements
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ASTM International (ASTM)

ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C62	Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C90	Standard Specification for Loadbearing Concrete Masonry Units
ASTM D2823	Standard Specification for Asphalt Roof Coatings, Asbestos Containing
ASTM D4479	Standard Specification for Asphalt Roof Coatings – Asbestos-Free

Commercial Item Description (CID)

A-A 59544	Cable and Wire, Electrical (Power, Fixed Installation)
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Institute of Electrical and Electronic Engineers (IEEE)

IEEE 1584	Guide for Performing Arc-Flash Hazard Calculations
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Master Painter's Institute (MPI)

MPI Reference #9	Alkyd, Exterior, Gloss (MPI Gloss Level 6)
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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 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

National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)
NFPA-70E	Standard for Electrical Safety in the Workplace
NFPA-780	Standard for the Installation of Lightning Protection Systems

END OF ITEM L-109

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Item L-110 Airport Underground Electrical Duct Banks and Conduits

DESCRIPTION

110-1.1 This item shall consist of underground electrical conduits and duct banks (single or multiple conduits encased in concrete or buried in sand) installed per this specification at the locations and per the dimensions, designs, and details shown on the plans. This item shall include furnishing and installing of all underground electrical duct banks and individual and multiple underground conduits. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.

EQUIPMENT AND MATERIALS

110-2.1 General.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, that comply with these specifications, at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be electronically submitted in pdf format, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes specified in this document.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

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 Engineer approved third party certification program. Precast concrete structures shall conform to ASTM C478.

110-2.8 Flowable backfill. Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

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 Engineer shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches (50 mm) inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches (75 mm) per 100 feet (30 m). On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. 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 Engineer of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200-pound (90 kg) test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet (1.5 m).

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 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 Engineer. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (60 cm).

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the Engineer, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the Engineer.

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 Engineer to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the Engineer and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred.

b. Trenching, etc., in cable areas shall then proceed with approval of the Engineer, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

110-3.2 Duct banks. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches (0.5 m) below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 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 Engineer for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot (1.5-m) intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the Engineer shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the Engineer.

110-3.3 Conduits without concrete encasement. Trenches for single-conduit lines shall be not less than 6 inches (150 mm) nor more than 12 inches (300 mm) wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be

retained on a 1/4-inch (6.3 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 Engineer for review prior to use.

110-3.4 Markers. The location of each end and of each change of direction of conduits and duct banks shall be marked by a concrete slab marker 2 feet (60 cm) square and 4 - 6 inches (100 - 150 mm) thick extending approximately one inch (25 mm) above the surface. The markers shall also be located directly above the ends of all conduits or duct banks, except where they terminate in a junction/access structure or building. Each cable or duct run from a line of lights and signs to the equipment vault must be marked at approximately every 200 feet (61 m) along the cable or duct run, with an additional marker at each change of direction of cable or duct run.

The Contractor shall impress the word "DUCT" or "CONDUIT" on each marker slab. Impression of letters shall be done in a manner, approved by the Engineer, for a neat, professional appearance. All letters and words must be neatly stenciled. After placement, all markers shall be given one coat of high-visibility orange paint, as approved by the Engineer. The Contractor shall also impress on the slab the number and size of conduits beneath the marker along with all other necessary information as determined by the Engineer. The letters shall be 4 inches (100 mm) high and 3 inches (75 mm) wide with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep or as large as the available space permits. Furnishing and installation of duct markers is incidental to the respective duct pay item.

110-3.5 Backfilling for conduits. For conduits, 8 inches (200 mm) of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 except that material used for back fill shall be select material not larger than 4 inches (100 mm) in diameter.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the Engineer.

110-3.6 Backfilling for duct banks. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the requirements of 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 Engineer.

110-3.7 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include topsoiling, fertilizing, seeding, and mulching shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. All restoration shall be considered incidental to the respective L-110 pay item. Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD) and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

110-3.8 Ownership of removed cable. Removed cable shall become the property of the Contractor

METHOD OF MEASUREMENT

110-4.1 Underground conduits and duct banks shall be measured by the linear feet of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated material, and restoration, and for drain lines, the termination at the drainage structure, all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for 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-110-5.1 Concrete Encased Electrical Conduit, (number)(size) – 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 Engineer. This item shall include the installation of each electrical manhole and/or junction structures with all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, ladders, appurtenances, testing, dewatering and restoration of surfaces to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

115-2.1 General.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be electronically submitted in pdf format, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes, specified in this document.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

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 aircraft loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.

Threaded inserts and pulling eyes shall be cast in as shown 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 Engineer shall be submitted by the Contractor to allow for a full evaluation by the Engineer. The Engineer shall review per the process defined in the General Provisions.

115-2.4 Junction boxes. Junction boxes shall be L-867 Class 1 (non-load bearing) or L-868 Class 1 (load bearing) airport light bases that are encased in concrete. The light bases shall have a L-894 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 and 3/4-inch (19-mm) thickness for L-868. 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 tire pressure of 200 psi and maximum load of 200,000 lbs.~~ the loadings, aircraft gear configuration and/or direct loading, specified

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. Ladders, if specified, shall be galvanized steel or as shown on the plans.

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. Flowable material used to backfill shall conform to the requirements of Item P-153, Controlled Low Strength Material.

115-2.12 Cable trays. Cable trays shall be of galvanized steel or plastic. Cable trays shall be located as shown on the plans.

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 one piece, solid stainless steel, copper, or copper clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 10 feet long nor less than 3/4 inch in diameter.

CONSTRUCTION METHODS

115-3.1 Unclassified excavation. It is the Contractor’s responsibility to locate existing utilities within the work area prior to excavation. Damage to utility lines, through lack of care in excavating, shall be repaired or replaced to the satisfaction of the Engineer without additional expense to the Owner.

The Contractor shall perform excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.

All excavation shall be unclassified and shall be considered incidental to 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 Engineer. All seams, crevices, disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

The Contractor shall provide all bracing, sheeting and shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheeting and shoring shall be included in the unit price bid for the structure.

Unless otherwise provided, bracing, sheeting and shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

After each excavation is completed, the Contractor shall notify the Engineer. Structures shall be placed after the Engineer has approved the depth of the excavation and the suitability of the foundation material.

Prior to installation the Contractor shall provide a minimum of 6 inches (150 mm) of sand or a material approved by the Engineer as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

115-3.2 Concrete structures. Concrete structures shall be built on prepared foundations conforming to the dimensions and form indicated on the plans. The concrete and construction methods shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Engineer before the concrete is placed.

115-3.3 Precast unit installations. Precast units shall be installed plumb and true. Joints shall be made watertight by use of sealant at each tongue-and-groove joint and at roof of manhole. Excess sealant shall be removed and severe surface projections on exterior of neck shall be removed.

115-3.4 Placement and treatment of castings, frames and fittings. All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the Engineer and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

Field connections shall be made with bolts, unless indicated otherwise. Welding will not be permitted unless shown otherwise on the approved shop drawings and written 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 Engineer and approval of the method of correction shall be obtained. Approved corrections shall be made at Contractor's expense.

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

Pulling-in irons shall be located opposite all conduit entrances into structures to provide a strong, convenient attachment for pulling-in blocks when installing cables. Pulling-in irons shall be set directly into the concrete walls of the structure.

115-3.5 Installation of ladders. Ladders shall be installed such that they may be removed if necessary. Mounting brackets shall be supplied top and bottom and shall be cast in place during fabrication of the structure or drilled and grouted in place after erection of the structure.

115-3.6 Removal of sheeting and bracing. In general, all sheeting and bracing used to support the sides of trenches or other open excavations shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a structure shall be withdrawn, unless otherwise directed, before more than 6 inches (150 mm) of material is placed above the top of the

structure and before any bracing is removed. Voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.

The Engineer may 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 Engineer.

Backfill shall not be placed against any structure until approval is given by the Engineer. In the case of concrete, such approval shall not be given until tests made by the laboratory under supervision of the Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

Where required, the Engineer may direct the Contractor to add, at his own expense, sufficient water during compaction to assure a complete consolidation of the backfill. The Contractor shall be responsible for all damage or injury done to conduits, duct banks, structures, property or persons due to improper placing or compacting of backfill.

115-3.8 Connection of duct banks. To relieve stress of joint between concrete-encased duct banks and structure walls, reinforcement rods shall be placed in the structure wall and shall be formed and tied into duct bank reinforcement at the time the duct bank is installed.

115-3.9 Grounding. A ground rod shall be installed in the floor of all concrete structures so that the top of rod extends 6 inches (150 mm) above the floor. The ground rod shall be installed within one foot (30 cm) of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor shall drill a 4-inch (100 mm) diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod.

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of one foot (30 cm) above the floor of the structure and separate from other cables. No. 2 American wire gauge (AWG) bare copper 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. The Contractor shall adjust the tops of existing manholes in areas designated in the Contract Documents to the new elevations shown. The Contractor shall be responsible for determining the exact height adjustment required to raise or lower the top of each manhole to the new elevations. The existing top elevation of each manhole to be adjusted shall be determined in the field and subtracted/added from the proposed top elevation.

The Contractor shall remove/extend the existing top section or ring and cover on the manhole structure or manhole access. The Contractor shall install precast concrete sections or grade rings of the required dimensions to adjust the manhole top to the new proposed elevation or shall cut the existing manhole walls to shorten the existing structure, as required by final grades. The Contractor shall reinstall the manhole top section or ring and cover on top and check the new top elevation.

The Contractor shall construct a concrete slab around the top of adjusted structures located in graded areas that are not to be paved. The concrete slab shall conform to the dimensions shown on the plans.

115-3.14 Duct extension to existing ducts. Where existing concrete encased ducts are to be extended, the duct extension shall be concrete encased plastic conduit. The fittings to connect the ducts together shall be standard manufactured connectors designed and approved for the purpose. The duct extensions shall be installed according to the concrete encased duct detail and as shown on the plans.

METHOD OF MEASUREMENT

115-4.1 Electrical manholes 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.

115-4.2 Manhole elevation adjustments shall be measured by the completed unit installed, in place, completed, and accepted. Separate measurement shall not be made for the various types and sizes.

BASIS OF PAYMENT

115-5.1 The accepted quantity of electrical manholes and junction structures will be paid for at the Contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials, furnishing and installation of appurtenances and connections to duct banks and other structures as may be required to complete the item as shown on the plans and for all labor, equipment, tools and incidentals necessary to complete the structure.

115-5.2 Payment shall be made at the contract unit price for manhole elevation adjustments. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary, including but not limited to, spacers, concrete, rebar, dewatering, excavating, backfill, topsoil, sodding and pavement restoration, where required, to complete this item as shown in the plans and to the satisfaction of the Engineer.

Payment will be made under:

Item L-115-5.1 In-Pavement Runway Centerline Can (L-868B) with Cover Plate - per each

Item L-115-5.1 In-Pavement Runway Edge Light Can (L867B) – per each

Item L-115-5.2 Existing Electrical Manhole/Junction Structure Elevation Adjustment - 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

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)

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
Mil Spec	
MIL-P-21035	Paint High Zinc Dust Content, Galvanizing Repair
National Fire Protection Association (NFPA)	
NFPA-70	National Electrical Code (NEC)

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 Engineer.

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 Engineer. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

c. All materials and equipment used shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. 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 Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted in electronic PDF format, tabbed by specification section. The Engineer reserves the right to reject any or all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. All LED light fixtures shall be warranted by the manufacturer for a minimum of four (4) years after date of installation inclusive of all electronics. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

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. Not required.

125-2.7 Runway and Taxiway Lights. Runway and taxiway lights shall conform to the requirements of AC 150/5345-46. Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors conforming to the specification for the light concerned or to the standard referenced.

Lights

Type	Class	Mode	Style	Option	Base	Filter	Transformer	Notes
SEE PLANS								

125-2.8 Runway and Taxiway Signs. Not required.

125-2.9 Runway End Identifier Light (REIL). Not required.

125-2.10 Precision Approach Path Indicator (PAPI). Not required.

125-2.11 Circuit Selector Cabinet. Not required.

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-868, 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-830, 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 Engineer, 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 and In-pavement Lights. Water, debris, and other foreign substances shall be removed prior to installing fixture base and light.

A jig or holding device shall be used when installing each light fixture to ensure positioning to the proper elevation, alignment, level control, and azimuth control. Light fixtures shall be oriented with the light beams parallel to the runway or taxiway centerline and facing in the required direction. The outermost edge of fixture shall be level with the surrounding pavement. Surplus sealant or flexible embedding material shall be removed. The holding device shall remain in place until sealant has reached its initial set.

METHOD OF MEASUREMENT

125-4.1 Runway and taxiway lights will be measured by the number of each type installed as completed units in place, ready for operation, and accepted by the Engineer.

BASIS OF PAYMENT

125-5.1 Payment will be made at the Contract unit price for each complete runway or taxiway light, installed by the Contractor and accepted by the Engineer. 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-125-5.1 L-850A(L) In-Pavement Runway Centerline Light - per each

Item L-125-5.1 Adjust L-850C In-Pavement HIRL - per each

Item L-125-5.1 Adjust L-861T Base Mounted MITL - per each

Item L-125-5.1 Adjust L-862(L) In-Pavement HIRL - 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	Airport Lighting Equipment Certification Program
Engineering Brief (EB)	
EB No. 67	Light Sources Other than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures

END OF ITEM L-125

Other Specifications

for

Rehabilitate Runway 6-24

at

Roanoke-Blacksburg Airport

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Item M-103 Closed Runway or Taxiway Markers

DESCRIPTION

103-1.1 Closed runway and taxiway markers shall be installed and maintained at the time and location indicated on the plans, or when ordered by the Engineer. The markers shall remain in place and clearly visible until the runway and taxiway are operational. The Contractor shall make a frequent inspection of the markers and make prompt repairs, as necessary.

MATERIALS

103-2.1 Lighted Portable (Mobile) Closed Runway Markers. Lighted portable (mobile) closed runway markers shall be furnished by the Owner. Markers shall be in accordance with AC 150/5345-55, “Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure” and shall be operated and maintained by the Contractor.

Owner-furnished lighted portable (mobile) closed runway markers shall be returned in good physical condition at the completion of the project. At a minimum, the Contractor shall change the oil in the markers prior to use and when returned to the Owner. The Contractor shall be responsible for maintenance and usage costs (fuel, bulbs, etc.) for the project duration and for returning the markers to the airport storage yard.

103-2.2 Closed Taxiway Markers. Closed taxiway markers may be constructed of plywood, lumber, cloth, plastic, or other satisfactory material as approved by the Engineer and secured to the pavement with sandbags or other method approved by the Engineer. The color shall be aviation yellow.

METHOD OF MEASUREMENT

103-3.1 Lighted portable (mobile) closed runway markers shall be measured by the unit. No separate measurement will be made for operation or relocation of the markers.

103-3.2 Closed taxiway markers shall be measured by unit. No separate measurement will be made for relocation of the markers.

BASIS OF PAYMENT

103-4.1 The accepted quantity of lighted portable (mobile) closed runway markers will be paid for at the contract unit price per each. The price shall be full compensation for furnishing all materials, labor, and incidentals necessary to install, secure to pavement, inspect, and maintain each marker for the duration of the project.

103-4.2 The accepted quantity of closed taxiway markers will be paid for at the contract unit price per each. The price shall be full compensation for furnishing all materials, labor, and incidentals necessary to install, secure to pavement, inspect, and maintain each marker for the duration of the project.

Payment will be made under:

Item M-103-4.1 Lighted Portable Closed Runway Markers (Contractor Furnished) - per each

Item M-103-4.1 Closed Taxiway Markers - per each

END OF ITEM M-103

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Item M-107 Aviation Barricades

DESCRIPTION

107-1.1 Aviation barricades shall be furnished by the Contractor and placed and maintained as shown on the plans or as ordered by the Engineer. The aviation barricades shall be installed when ordered by the Engineer. The aviation barricades shall remain in-place, clearly visible, until ordered removed by the Engineer. Flashing or steady burning red lights shall be placed on the barricades for nighttime use. Aviation barricades shall be placed a maximum of four (4) feet apart.

MATERIALS

107-2.1 Materials shall be as shown on the plans.

METHOD OF MEASUREMENT

107-3.1 Aviation barricades shall be measured per linear foot of the longest area barricaded at any one time including spaces between the barricades. No separate measurement will be made for relocation of the aviation barricades.

BASIS OF PAYMENT

107-4.1 The accepted quantity of aviation barricades will be paid for at the contract unit price per linear foot. The price shall be full compensation for furnishing all materials, labor and incidentals, necessary to install, inspect and maintain the barricades for the duration of the project.

Payment will be made under:

Item M-107-4.1 Aviation Barricades (Contractor Furnished) - per linear foot

END OF ITEM M-107

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Item M-199 Major Sinkhole Treatment

DESCRIPTION

199-1.1 This item shall consist of excavating, removing, stockpiling, exposing bedrock, backfilling with aggregate, and any other incidentals necessary to complete this item in accordance with the plans and as ordered by the Engineer.

The Contractor shall notify the Engineer one (1) week in advance of the start of work on this item.

MATERIALS

199-2.1 The materials for this item shall be approved quality aggregate material as described in these specifications or as shown on the plans. Once the sinkhole has been completely exposed by the Contractor, the Engineer shall evaluate the limits and size of coarse aggregate for the stone filter. The Engineer may elect to utilize one or a combination of the following items:

- a. VDOT, Class 1 Riprap
- b. VDOT, Coarse Aggregate No. 1
- c. VDOT, Coarse Aggregate No. 57
- d. VDOT, Base Course 21A
- e. VDOT, Section 249, Flowable Fill
- f. Civil Engineering Fabric

All VDOT materials shall meet the requirements of the current edition of the Virginia Department of Transportation Road and Bridge Specifications.

The fabric shall be a non-woven, Class 2 Geotextile Fabric per AASHTO M288. The Contractor shall submit manufacturer's certifications and/or literature for materials to be used.

CONSTRUCTION METHODS

199-3.1 The Contractor shall utilize muck excavation methods as described in Item P-152.

Excavation of the sinkhole shall be by the equipment and methods elected by the Contractor. Side slopes of the excavation shall be approximately 1:1 (horizontal:vertical) but need not be cut to neat lines and grades. The Engineer will be on-site to evaluate the limits of the sinkhole and to make material selections for the stone filter backfill. Once excavation has started, the Contractor shall work continuously during normal working hours on this item to expedite treatment of the sinkhole and preclude erosion.

The stone filter material designated by the Engineer shall be placed in lifts as ordered by the Engineer. Compaction of each lift of the stone filter will be accomplished by mechanical means to the satisfaction of the Engineer.

METHOD OF MEASUREMENT

199-4.1 Muck excavation for the treatment of the sinkhole shall be measured as described in Item P-152. Excavation beyond the 1:1 (horizontal:vertical) side slopes shall not be measured for payment.

199-4.2 Aggregate material shall be measured by the number of tons of stone material placed. Net weight information shall be furnished with each load of material delivered.

199-4.3 Flowable fill shall be measured by the cubic yard delivered and placed. Delivery tickets shall be furnished with each load of material delivered.

199-4.4 Civil engineering fabric shall be measured by the square yard in place.

BASIS OF PAYMENT

These prices shall be full compensation for furnishing and placing all material and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

199-5.1 Payment for muck excavation shall be made under Item P-152.

199-5.2 Payment for aggregate material shall be made at the contract unit price per ton.

199-5.3 Payment for flowable fill shall be made at the contract unit price per cubic yard.

199-5.4 Payment for civil engineering fabric shall be made at the contract unit price per square yard.

Payment will be made under:

Item M-199-5.2 VDOT, Class 1 Riprap - per ton

Item M-199-5.2 VDOT, No. 1 Coarse Aggregate - per ton

Item M-199-5.2 VDOT, No. 57 Coarse Aggregate - per ton

Item M-199-5.2 VDOT, Base Course 21A - per ton

Item M-199-5.3 VDOT, Section 249, Flowable Fill - per cubic yard

Item M-199-5.4 Civil Engineering Fabric - per square yard

END OF ITEM M-199

Item M-406 Crack Reduction Membrane

DESCRIPTION

406-1.1 This item shall consist of the installation of an asphaltic crack reduction membrane. The membrane shall be applied in accordance with the manufacturer's guidelines. A technical representative from the manufacturer shall be present at the site during the first day of installation of the product.

MATERIALS

406-2.1 Crack Reduction Membrane. The crack reduction membrane shall be a heavy-duty, high strength pavement repair geo-composite membrane used to reinforce and waterproof pavement cracks and joints and to reduce reflective cracking of asphalt concrete overlays. The membrane shall be composed of a flexible, high density asphalt mastic bitumen between a top layer of heat resistant, high strength woven polyester reinforcing fabric and a bottom layer of non-woven heat resistant polyester fabric.

The crack reduction membrane shall meet the following properties:

Material Properties

Properties	Requirement	Test Method
Thickness	0.135 in (3.4 mm) min	ASTM D1777
Weight	0.8 lb/sf (3.7 kg/m ²) min	
Mastic Density	80 PCF (1.28 g/cc) min	ASTM D70
Cold Flexibility	Pass at 32°F (0°C)	ASTM D146 (mod)
Tensile Strength	2000 psi (13.3 MPa) min	ASTM D412, Die C
Elongation	20% min	ASTM D412, Die C
Brittleness	Pass	ASTM D517
Mastic Softening Point	210°F (99°C) min	ASTM D36
Puncture Resistance	450 lb (2202N) min	ASTM E154
Absorption (Mastic)	1% max	ASTM D517
Thickness Retention	75% min	ASTM D395 (mod)

406-2.2 Bituminous Material. The bituminous materials shall be PG 64-22 and conform to AASHTO M-226.

CONSTRUCTION METHODS

406-3.1 Weather Limitations. The asphalt tack coat shall be applied only when the existing surface is clean and dry, and the surface temperature is 50 degrees F and rising and when the weather is not foggy or rainy.

406-3.2 Surface Preparation. The surface on which the fabric is to be placed shall be free of all dirt, water, and vegetation. Cracks greater than 1/4 inch shall be cleaned and filled in accordance with Item P-101 "Preparation of Existing Pavements." Any spall greater than 2 inches in diameter, which will cause a failure of the material to bond to the pavement or leave a cavity under the material, shall be corrected prior to the placement of the fabric. Cracks and/or joints vertical elevation variations greater than 1/2 inch shall be wedged with compacted bituminous asphalt to level the area.

406-3.3 Membrane Installation. Installation of the fabric shall be in accordance with the manufacturer's recommendations. The membrane must be installed in a minimum width of eighteen (18) inches centered over the crack, with no curled or uplifted edges, in a wrinkle free manner. Small wrinkles shall be hand broomed to removal. Large wrinkles (1" or greater in length) shall be cut and overlapped in the direction of the paving operation. Transverse joints and the intersection of transverse/longitudinal joints shall be butted. Immediately after placement, the membrane shall be rolled with a static drum or rubber wheeled roller. The rolling shall consist of three (3) or more passes.

The Contractor shall ensure a minimum of 1.5 inches of bituminous concrete asphalt overlay on the membrane. When using a vibratory roller for compaction, care shall be taken to avoid the use of excessive roller amplitude on areas with the membrane.

METHOD OF MEASUREMENT

406-4.1 The quantity of crack reduction membrane shall not be measured for payment.

BASIS OF PAYMENT

406-5.1 Payment shall not be made for crack reduction membrane.

END OF ITEM M-406

SECTION H - Appendices

for

Rehabilitate Runway 6-24

at

Roanoke-Blacksburg Airport

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Appendix A - Other Forms

SAMPLE SUBMITTAL FORM

Project Name: Rehabilitate Runway 6-24

Delta Project #: 24072 - ROA

Submittal #:

Submittal Description:

Bid/Pay Item #:

Drawing Sheet #:

Date:

CONTRACTOR CERTIFICATIONS:

This shop drawing has been reviewed by [*Name of Contractor*] and approved with respect to the means, methods, techniques, sequences, procedures of construction, safety precautions and programs incidental thereto. [*Name of Contractor*] also warrants that this shop drawing complies with the contract documents and comprises no variations thereto, unless noted below.

[*Name of Contractor*] certifies that this shop drawing complies with Buy American requirements as established under 49 USC Section 50101. Steel products must be 100% U.S. domestic product Manufactured Products. Preference shall be given to products that are 100% manufactured and assembled in the U.S. Manufactured products not meeting the 100% U.S. domestic preference may only be used on the project if the FAA has officially granted a permissible waiver to Buy American Preferences.

PROPOSED VARIATIONS OR SUBSTITUTIONS

Signature: _____

Date: _____

Printed Name: _____

Company Name: _____

**ELECTRONIC FILE RELEASE AGREEMENT
FOR BID DOCUMENT PLAN HOLDERS**

Project: 24072 – ROA Rehabilitate Runway 6-24

_____ (RECIPIENT) has requested that Delta Airport Consultants, Inc., (ENGINEER) provide electronic files for the RECIPIENT's use on the above-referenced project at Roanoke-Blacksburg Airport, subject to the following terms and conditions.

Electronic files are available only to bid document plan holders.

The ENGINEER's electronic files are compatible with AutoCAD 2018 or newer releases. The ENGINEER makes no representation as to the compatibility of these files with the RECIPIENT's hardware or software.

Data contained in these electronic files is part of the ENGINEER's instruments of service, who shall be deemed the author and shall retain all common law, statutory law, and other rights, without limitation, including copyrights, and shall not be used by the RECIPIENT or anyone else receiving this data through or from the RECIPIENT for any purpose other than **assisting with bid quantity take off**. Any other use or reuse by the RECIPIENT or others will be at the sole risk of the user and without liability or legal exposure to the ENGINEER. The RECIPIENT agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against the ENGINEER, its officers, directors, employees, agents or subconsultants which may arise out of or in conjunction with the RECIPIENT's use or reuse of the electronic files for any purpose other than noted above.

Furthermore, the RECIPIENT shall, to the fullest extent permitted by law, indemnify and hold harmless the ENGINEER from all claims, damages, losses, and expenses, including attorney's fees, arising out of or resulting from such use or reuse, by the RECIPIENT or others, of these electronic files for any purpose other than noted above.

These electronic files are not contract documents, nor are they considered as being the engineering drawings for the project. Significant differences may exist between these electronic files and corresponding hard copy contract documents (project engineering drawings) due to addenda, change orders, or other revisions. The ENGINEER makes no representation regarding the accuracy or completeness of the electronic files received by the RECIPIENT. **In the event a conflict arises between the signed contract documents prepared by the ENGINEER and electronic files, the signed contract documents shall govern.** The RECIPIENT is responsible for determining if any conflicts exist.

By the RECIPIENT's use of these electronic files, the RECIPIENT is not relieved of his duty to fully comply with the contract documents, including and without limitation, the need to check, confirm, and coordinate all dimensions and details, take measurements, verify field conditions and coordinate work with that of other contractors for the project.

Because of the potential that the information presented on the electronic files can be modified, unintentionally or otherwise, the ENGINEER reserves the right to remove all indicia of its ownership and/or involvement from each electronic display or file.

Signature of this agreement shall cover the 2D digital files associated with the selected plan sheets noted below and released from the ENGINEER to the RECIPIENT. **Place an "X" by the requested plan sheets.**

☐ Demolition Plan
☐ Geometric Layout
☐ Grading and Drainage
☐ Erosion and Sediment Control Layout
☐ Fence Layout
☐ Joint Layout
☐ Marking Layout
☐ Electrical Layout
☐ Utility Layout
☐ Cross Sections

Under no circumstances shall delivery of the electronic files for use by the RECIPIENT be deemed a sale by the ENGINEER, and the ENGINEER makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall the ENGINEER be liable for any loss of profit or any consequential damages as a result of the use or reuse of these electronic files.

 RECIPIENT (print company name)

 RECIPIENT's Representative Signature

 RECIPIENT's Representative (print)

 Date Signed

 RECIPIENT's Email Address (print)

 [_____]

 Witness Signature

 RECIPIENT's Phone Number

**ELECTRONIC FILE RELEASE AGREEMENT
FOR THE SUCCESSFUL LOW BIDDER**

Project: 24072 – ROA Rehabilitate Runway 6-24

_____ (RECIPIENT) has requested that Delta Airport Consultants, Inc., (ENGINEER) provide electronic files for the RECIPIENT's use on the above-referenced project at Roanoke-Blacksburg Airport, subject to the following terms and conditions.

Electronic files are available only to the successful low bidder.

The ENGINEER's electronic files are compatible with AutoCAD 2018 or newer releases. The ENGINEER makes no representation as to the compatibility of these files with the RECIPIENT's hardware or software.

Data contained in these electronic files is part of the ENGINEER's instruments of service, who shall be deemed the author and shall retain all common law, statutory law, and other rights, without limitation, including copyrights, and shall not be used by the RECIPIENT or anyone else receiving this data through or from the RECIPIENT for any purpose other than **assisting with project stakeout**. Any other use or reuse by the RECIPIENT or others will be at the sole risk of the user and without liability or legal exposure to the ENGINEER. The RECIPIENT agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against the ENGINEER, its officers, directors, employees, agents or subconsultants which may arise out of or in conjunction with the RECIPIENT's use or reuse of the electronic files for any purpose other than noted above.

Furthermore, the RECIPIENT shall, to the fullest extent permitted by law, indemnify and hold harmless the ENGINEER from all claims, damages, losses, and expenses, including attorney's fees, arising out of or resulting from such use or reuse, by the RECIPIENT or others, of these electronic files for any purpose other than noted above.

These electronic files are not contract documents, nor are they considered as being the engineering drawings for the project. Significant differences may exist between these electronic files and corresponding hard copy contract documents (project engineering drawings) due to addenda, change orders, or other revisions. The ENGINEER makes no representation regarding the accuracy or completeness of the electronic files received by the RECIPIENT. **In the event a conflict arises between the signed contract documents prepared by the ENGINEER and electronic files, the signed contract documents shall govern.** The RECIPIENT is responsible for determining if any conflicts exist.

By the RECIPIENT's use of these electronic files, the RECIPIENT is not relieved of their duty to fully comply with the contract documents, including and without limitation, the need to check, confirm, and coordinate all dimensions and details, take measurements, verify field conditions and coordinate work with that of other contractors for the project.

Because of the potential that the information presented on the electronic files can be modified, unintentionally or otherwise, the ENGINEER reserves the right to remove all indicia of its ownership and/or involvement from each electronic display or file.

Signature of this agreement shall cover the digital files associated with the requested plan sheets/files listed below and released from the ENGINEER to the RECIPIENT. **Coordinate the selection of plan sheets/files with the Engineer before signing and submitting this electronic release form.**

_____ Demolition Plan
 _____ Geometric Layout
 _____ Grading and Drainage () 2D or () 3D
 _____ Erosion and Sediment Control Layout () 2D or () 3D
 _____ Fence Layout
 _____ Joint Layout
 _____ Marking Layout
 _____ Electrical Layout
 _____ Utility Layout
 _____ Cross Sections

Under no circumstances shall delivery of the electronic files for use by the RECIPIENT be deemed a sale by the ENGINEER and the ENGINEER makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall the ENGINEER be liable for any loss of profit or any consequential damages as a result of the use or reuse of these electronic files.

 RECIPIENT (print company name)

 RECIPIENT's Representative Signature

 RECIPIENT's Representative (print)

 Date Signed

 RECIPIENT's Email Address (print)

 [_____]

 Witness Signature

 RECIPIENT's Phone Number

Appendix B - Construction Safety and Phasing Plan (CSPP)

CONSTRUCTION SAFETY & PHASING PLAN

Rehabilitate Runway 6-24

Roanoke-Blacksburg Regional Airport

Roanoke, Virginia

AIP Project No. 3-51-0045-074-2025

State Project No. Entitlements

Delta Project No. 24072

April 2026

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INTRODUCTION

Aviation safety is a primary consideration at airports, especially during construction. In accordance with FAA Advisory Circular (AC) 150/5370-2G, "Operational Safety on Airports During Construction," a Construction Safety and Phasing Plan (CSPP) must be developed on each on-airfield construction project funded by the Airport Improvement Program (AIP), Passenger Facility Charge (PFC) program or for any project located on an airport certificated under Part 139.

The CSPP sets forth benchmarks and requirements for the project and is the airport operator's guideline for developing the highest levels of safety, security, and efficiency at the airport during project construction. The CSPP is to be used by all personnel involved in the project, including construction personnel, inspection personnel, and airport staff. This document has been developed for this construction project in order to minimize interruptions to airport operations, control construction costs, and maximize the performance and safety of construction activity.

The Contractor shall be required to submit a Safety Plan Compliance Document (SPCD) to the airport operator describing how the Contractor will comply with the requirements set forth in this CSPP. The SPCD must be submitted to and approved by the airport operator prior to issuance of the Notice to Proceed. The SPCD includes a certification statement by the Contractor that indicates it understands the operational safety requirements of the CSPP and asserts it will not deviate from the approved CSPP and SPCD unless written approval is granted by the airport operator.

In the event the Contractor's activities are found in non-compliance with the provisions of the CSPP or the SPCD, the Contractor shall immediately cease those operations in violation. In addition, the Contractor will conduct a safety meeting, with the airport operator's representative present, and review those provisions in the CSPP/SPCD which were violated. The Contractor will not be allowed to resume construction operations until conclusion of the safety meeting and implementation of corrective actions.

PROJECT SCOPE

This CSPP has been prepared for upcoming airfield projects at the Roanoke-Blacksburg Regional Airport in Roanoke, Virginia. The project includes the design for the pavement rehabilitation of Runway 6-24. The scope of the project was developed to improve the current runway that does not meet FAA standards. Aspects of the runway, such as fillet geometry and safety area grades, were evaluated and included in the project scope to help improve compliance with current FAA standards. The project scope includes the following major items:

- 3" mill and overlay of Runway 6-24, including shoulders
- Thickened pavement in structurally deficient sections of Runway 6-24
- Installation of a new runway centerline lighting system for Runway 6-24

The Roanoke-Blacksburg Regional Airport is an Airport Reference Code (ARC) C-IV facility with regularly scheduled passenger service. The airport has two runways, 6-24 which is 6,800 long by 150 feet wide and Runway 16-34 which is 5,810 feet long by 150 feet wide. Operations are supported through a contract air traffic control tower that is open 24 hours a day, 7 days a week.

1. COORDINATION

Coordination of safety issues will occur throughout all stages of the project. Key conferences and meetings include:

1.1. Design Coordination

Design coordination will be completed with the affected agencies and organizations to discuss operational safety. Participants will include the airline station managers, tenants, funding agencies, FAA ATCT, ARFF personnel, FAA District Office, State Aviation personnel, the Engineer, and airport operator staff. Input will be solicited on key safety issues to be considered, methods to ensure safety during construction, required protocols, advance notices, and other requirements that need to be incorporated in the contract bid documents.

1.2. Prebid Meeting

A prebid meeting with potential bidders and construction contractors will take place. The meeting will be held approximately 10 days prior to the bid opening date. During the meeting, safety will be discussed, with an emphasis on the unique aspects of construction on an active airfield. FAA Advisory Circular 150/5370-2G will be reviewed, as will the requirements for the Contractor-prepared SPCD. It will be made clear in both the contract documents as well as the pre-bid meeting that the SPCD is the responsibility of the Contractor.

1.3. Preconstruction Meeting

A preconstruction meeting will be held once a construction contract has been awarded, but prior to the start of construction. Invitees will include airline station managers, users, tenants, prime contractor, subcontractors, funding agencies, ATCT, ARFF personnel, FAA District Office, State Aviation personnel, the Engineer, Resident Project Representative, and the airport operator staff. The FAA Airports District Office should ensure that all appropriate FAA offices and Federal agencies that may have an interest in the project are notified.

The airport operator, or authorized agent will prepare an agenda prior to the preconstruction meeting. This will include, but not be limited to:

- a. project scope and phasing requirements;

- b. relationship between airport operator, airport operator's authorized agent, and the Contractor;
- c. relationship between the airport operator and the FAA;
- d. identification of Contractor's superintendent and discussion of authority and responsibilities;
- e. designation of airport operator representative responsible for notifying the Flight Service Station of any circumstances requiring a NOTAM;
- f. scheduling of work and phasing requirements;
- g. notice to proceed date;
- h. safety during construction, including responsibility for marking and lighting of closed and hazardous areas, all in accordance with FAA AC 150/5370-2G *Operational Safety on Airports During Construction*;
- i. security requirements;
- j. communications and documentation protocols, including contact information for all key personnel.

Emphasis will be placed on compliance with the established CSPP and approved SPCD.

1.4. Contractor Progress Meetings

Regular progress meetings will be held throughout the construction phase, with operational safety as a standing agenda item. Current compliance issues and upcoming critical work will be reviewed. Meeting participants will include the Engineer, the Resident Project Representative, the Contractor, and the airport operator. Daily meetings between the Resident Project Representative and key Contractor personnel will also occur to address daily work schedules and associated operational concerns. When necessary, appropriate FAA/State personnel, airport staff, or affected tenants will attend progress meetings.

1.5. Scope or Schedule Changes

Coordination between the Engineer, Contractor, FAA, and the airport operator will occur in the event of any scope or schedule changes. It will be determined if revisions to either the CSPP or the SPCD are required as a result of any scope or schedule changes. Revisions to these documents will be routed through the appropriate approval channels prior to beginning construction in areas of impact.

1.6. FAA ATCT Coordination

FAA ATCT Coordination must be kept informed of pending changes in airfield access and airfield naming conventions throughout the project, and their concurrence must be received prior to making any of these changes.

2. PHASING (CONSTRUCTION SEQUENCING)

This discussion reviews the construction phasing and work areas defined for the project. The phasing generally provides the desired sequencing for the project. The defined work areas address work limitations. These limitations are primarily associated with operational safety, focusing on maintaining adequate separation between the Contractor's activities and aircraft operations and limiting the time that Contractor activities impact airport operations. Refer to the phasing plans in Attachment A for work areas. General elements of this sequencing and phasing are described in the following subsections.

2.1. Construction Staging Areas

Refer to the phasing plans in Attachment A for staging area locations and general safety and security notes concerning use of the staging areas. Construction staging areas and Contractor employee parking areas are to remain outside of all object free areas and all safety areas for all active airfield surfaces.

2.2. Construction Access and Haul Routes

Refer to phasing plans in Attachment A for access and haul route locations and general safety and security notes concerning use of access and haul routes. Applicable control along haul routes for both safety and security must be maintained at all times.

2.3. Firefighting Access Routes

Emergency firefighting access in and around the site will be maintained by the Contractor, as required, for the duration of this project. Construction contractors must prominently mark open trenches and excavations within the construction site, with approval from the airport operator, and light them with red lights during hours of restricted visibility or darkness.

2.4. Required Hazard Marking and Lighting

Refer to the phasing plans in Attachment A for required hazard marking and lighting. Reference Sections 15, 16, and 17 of this CSPP for additional information.

2.5. Work Area Phasing.

Work areas have been defined to limit the Contractor's activities and minimize impact to airport operations. Work area phasing will be completed as follows:

- Work Area A: Runway 6 end, west of Runway 6-24 and Runway 16-34 intersection
- Work Area B: Intersection of Runway 6-24 and Runway 16-34
- Work Area C: Intersection of Taxiway A and Runway 6-24
- Work Area D: East of Taxiway A to Runway 24 end

The critical portion of the project being Work Area B when both runways will need to be closed during the work period. The placement of aviation barricades allows for aircraft from the Piedmont hangar to taxi to the terminal apron. All general aviation traffic is restricted to the apron.

During all work areas, the cargo apron will maintain access to Taxiway B. Connector Taxiways B1, B2, B3, B4, and B5 will remain closed for all work areas. Taxiway J will be completely closed off barricades. During Work Area B, both Runway 6-24 and Runway 16-34 are closed and have lighted runway markers. To limit the closure of Runway 16-34, Work Area C was created. Work Area C requires the additional closure of Taxiway A.

3. AREAS AND OPERATIONS AFFECTED BY CONSTRUCTION ACTIVITY

Runways and taxiways shall remain in use to the maximum extent possible without compromising safety. See Table 3-1 for a summary of effects on airport operations created by this project. Meetings with the Engineer, Contractor, FAA ATCT, and the airport operator will occur before construction begins on each phase. Items discussed during these meetings are described below:

3.1. Identification of Affected Areas

The affected areas for each construction phase are identified in the phasing plans in Attachment A.

3.1.1. Closing or partial closing of runways, taxiways, and aprons. See Attachment A. Also see Table 3-1 for a summary of effects on airport operations.

3.1.2. Closing of firefighting access routes. Access into, through, and/or around the project work area by emergency vehicles may be affected during construction. Refer to the phasing plans (Attachment A) for requirements.

3.1.3. Approach/departure surfaces affected by heights of objects. Contractor equipment used in the project and/or staging area may impact approach/departure surfaces. Equipment locations shall not violate runway Part 77 surfaces except under special waiver conditions. FAA Form 7460-1, *Notice of Proposed Construction or Alteration*, must be submitted by the airport operator to the FAA ADO, and approved prior to construction. Refer to the phasing plans (Attachment A) for requirements.

3.1.4. Construction areas. Construction areas, including actual construction, storage/stockpiles, employee parking, staging areas, and haul routes are located near active airfield surfaces. Refer to the phasing plans (Attachment A) for requirements.

Table 3-1 Effects on Airport Operations

Project	Runway 6-24 Rehabilitation	
Scope of work	Mill and overlay a portion of Runway 6-24, install runway centerline lights	
Operational Requirements	Normal (Existing)	Construction (Anticipated)
Runway 6 Approach Procedures	VASI, MALSR, LDA/DME	Nightly shutdowns NOTAMS OTS
Runway 24 Approach Procedures	PAPI	Nightly shutdowns NOTAMS OTS
Runway 34 Approach Procedures	PAPI, MALSR, ILS	Nightly shutdowns during closure periods NOTAMS OTS

3.2. Mitigation of Effects

Establishment of specific procedures is necessary to maintain the safety and efficiency of airport operations. All coordination pertaining to airport operations during construction shall be with the airport operator's designated representative. Specific contacts will be discussed in detail at the preconstruction meeting.

3.2.1. Temporary and permanent changes to runway and/or taxi operations. Affected runway and taxiways will be barricaded as indicated on the phasing plans (Attachment A).

3.2.2. Detours for ARFF and other airport vehicles. The project work site shall remain open to all firefighting and rescue vehicles in emergency situations. The Contractor is required to maintain access into the project work area for firefighting and rescue vehicles.

3.2.3. Maintenance of essential utilities. Special attention will be given by the Contractor to preventing unscheduled interruption of utility services and facilities. Where required by construction, the Contractor will follow prescribed procedures to locate all utilities (aboveground and underground) prior to working around them. All utility outages will be coordinated in advance in accordance with the procedures included in the plans and specifications. When a utility is damaged, it shall immediately be repaired by the Contractor in accordance with the procedures in the plans and specifications.

3.2.4. Temporary changes to air traffic control procedures. Changes to air traffic control procedures must be coordinated well in advance with the airport operator and ATO.

4. NAVIGATION AIDS (NAVAIDS) PROTECTION

Before beginning any construction activity, parking of equipment, or storing construction materials near a NAVAID, coordination with the appropriate FAA ATO to evaluate the effects of construction activity on the facility must take place. Necessary clearance distances will be coordinated at daily and weekly progress meetings (refer to Section 1, "Coordination"). NAVAIDS impacted by this project shall be identified through the NOTAM process described in Section 9, "Notification of Construction Activities." Underground utilities serving the NAVAIDS shall be protected as described in Section 11, "Underground Utilities." NAVAIDS for Runway 6-24 will be not operational during work periods. Runway 34 NAVAIDS will not be operation during the closure of the runway intersection.

5. CONTRACTOR ACCESS

5.1. Location of Stockpiled Construction Materials

Stockpiled materials and equipment storage are not permitted within the safety area, obstacle free zone, or object free area of any active runway or taxiway. Stockpiled materials shall be stored at a location approved by the airport operator and constrained in a manner to prevent movement resulting either from prop wash, jet blast, or wind. Stockpile heights shall not exceed 15 feet and shall not penetrate protected airspace (refer to the plans for information on protected airspace). Stockpiled materials and equipment adjacent to these areas shall be prominently marked and lighted during hours of restricted visibility or darkness. Further reference is directed to Section 6, “Wildlife Management,” Section 7, “Foreign Object Debris Management,” and Section 17, “Protection of Runway and Taxiway Safety Areas.”

5.2. Vehicle and Pedestrian Operations

Vehicle and pedestrian access routes for airport construction projects must be controlled to prevent inadvertent or unauthorized entry of persons, vehicles, or animals into the AOA.

5.2.1. Construction site parking. Vehicle parking areas for Contractor employees shall be as shown on the plans or as designated by the airport operator.

5.2.2. Construction equipment parking. Equipment not in use shall be parked in the construction staging area shown on the plans.

5.2.3. Access and haul roads. Access routes used by contractors shall be clearly marked to prevent inadvertent entry to open aircraft operational areas. If the access routes share or cross any routes designated for use by ARFF, right of way shall be maintained at all times unless alternate routes have been established. The Contractor shall only use the access and haul roads designated by the airport operator. The airport operator will provide access to the Contractor only after the Contractor has received training from the airport operator. These haul routes are shown in the construction plans.

5.2.4. Marking and lighting of vehicles. Equipment and vehicles shall be marked with 3-foot by 3-foot orange and white checker flags (day only) or yellow flashing dome type lights (day or night). Additionally, all Contractor vehicles operating in the AOA shall be clearly labeled with the Contractor's name visible from 200 feet.

5.2.5. Description of proper vehicle operations. Vehicle operations shall be in accordance with Advisory Circular 150/5210-20 "Ground Vehicle Operations on Airports."

5.2.5.1 Normal conditions. Project haul routes and phasing have been established to prevent the crossing of any open airfield pavements. At no time will vehicles or personnel enter portions of the secure AOA outside the contract area unless approved by the airport operator and accompanied by an airport operator escort. Any vehicle operators must successfully complete airport driver training, as administered by the airport operator, prior to operating a vehicle on the airfield.

5.2.5.2 Lost communications or emergency conditions. In the event that radio communications are lost, the driver shall follow the procedures taught in airport driver training. This include pulling the vehicle onto the shoulder out of the way of any possible aircraft. The vehicle shall then be turned to face the tower and flash the headlights to alert the tower. The tower shall give further instruction to the vehicle using a light gun. The driver must have knowledge of these signaling procedures.

5.2.6. Required escorts. All untrained drivers shall be escorted at all times when on the AOA side of the security fence. Escorted vehicles shall be marked and lighted in accordance with this Section 5.

5.2.7. Training requirements. The airport operator will provide access to the Contractor only after the Contractor has received safety and security training from the Owner. All Contractor personnel that will receive AOA badges shall be required to complete safety and security training and receive driver training prior to issuance of badges. Training sessions are approximately three hours in duration. Personnel and/or suppliers requiring only occasional access to the site shall be exempt from security training requirements, provided they are under the direct supervision and escort of a Contractor employee with an AOA badge.

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

5.2.9. Two-way radio communication procedures.

5.2.9.1. If prior approval and training has been obtained from the airport operator, and the proper equipment has been installed in AOA vehicles, the Contractor may be allowed to operate vehicles in active aircraft areas. Prior to entering any active safety area, the Contractor shall obtain clearance from the ATCT (Ground Control 121.90 MHz). Two-way radio communications shall be required at all times the Contractor is working in a runway or taxiway safety area, or on any paved surface that is open to aircraft traffic. The Contractor is responsible for providing radio equipment that is capable of maintaining clear communications with ATCT from all parts of the safety areas that the Contractor has permission to be in. No equipment or personnel shall enter an open runway or taxiway safety area unless properly coordinated with the ATCT. The use of trained flagmen and two-way radios shall be required in these areas. The Contractor shall have a two-way radio at the jobsite at all times work is in progress. Reference is directed to Section 5.

5.2.9.2. The Contractor shall have an adequate number of two-way radios on-site at all times and shall be responsible for providing the radios. The Contractor shall also check with the airport operator to ensure that all the frequencies are the intended frequencies to be used between the Contractor and the ATCT.

5.2.9.3. The Contractor shall be trained in proper radio usage including “read back” requirements. Proper phraseology including the Phonetic Alphabet will also be part of the training. The Contractor shall understand light gun signals in the event that there is a radio failure. Safety Placards from the “Ground Vehicle Guide to Airport Signs and Markings” will be given to the Contractor.

5.2.10. Maintenance of the secured area of the airport

5.2.10.1. Care shall be taken to maintain security during construction when access points are created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates shall be equipped so that they can be securely closed and locked to prevent access by animals and unauthorized persons. Procedures shall be established to ensure that only authorized persons and vehicles have access to the AOA and that vehicles are allowed through the gate one at a time, i.e. no “piggybacking” behind another person or vehicle. The Contractor is responsible for ensuring that all employees of the Contractor and Subcontractors use only the authorized access point to the AOA and verifying that the access point is secure immediately after use. Gates that fail shall be reported immediately to the airport operator and shall be guarded by the Contractor until the airport operator mobilizes to secure the opening.

5.2.10.2. The Contractor shall maintain separation between the airside and non-secure side of the airport at all times. The perimeter fence shall be maintained on a continuous basis with any temporary opening being continuously guarded by the Contractor’s designated employee. The airport is subject to FAA security requirements and rigid adherence is mandatory. Any fines for unauthorized personnel entering through the Contractor’s entrance points will be deducted from monies due the Contractor. Reference is directed to Section 5. Temporary openings and construction gates shall be secured and locked at the completion of work each day.

5.2.10.3. The Contractor shall delineate limits of construction prior to beginning work each day. The Contractor’s personnel shall not be beyond the limits of construction without authorization from the Owner. Violators are subject to removal from the jobsite and loss of AOA working privileges.

5.2.10.4. The Contractor shall submit a Security Plan at the Preconstruction Conference outlining the methods that the Contractor intends to apply in order to maintain airport security and of monitoring gate openings within and along the security fence.

5.2.10.5. The Airport reserves the right to require all personnel working inside the AOA to obtain a valid AOA badge or be under the direct supervision (within approximately 100 feet) of a person with an AOA badge. Personnel and/or suppliers requiring only occasional access to the site shall be exempt from security training requirements but shall be escorted by a badged employee at all times.

6. WILDLIFE MANAGEMENT

6.1. Trash

Food scraps shall be collected from construction personnel activity. Trash shall be disposed of weekly, or more frequently if necessary, to discourage wildlife encroachment.

6.2. Standing Water

Areas of standing water shall be kept to a minimum so as not to attract wildlife.

6.3. Tall Grass and Seeds

Only the grasses specified on the plans and in the specifications may be used for either temporary or permanent seeding. Incompatible plants could be an unwanted bird attractant.

6.4. Poorly Maintained Fencing and Gates

Reference is directed to Section 5 “Contractor Access” in regard to the importance of maintaining security on the airport so as to discourage access by wildlife.

6.5. Disruption of Existing Wildlife Habitat / Wildlife Sightings

Contractor personnel shall immediately notify the airport operator of significant wildlife sightings.

7. FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT

Waste and loose materials, commonly referred to as FOD, are capable of causing damage to aircraft landing gears, propellers, and jet engines. Materials capable of creating FOD shall be continuously removed during the project and must not be left or placed near active aircraft movement areas. The following measures will be utilized to control and monitor FOD:

- Worksite housekeeping

- Ground vehicle tire inspections
- Runway and taxiway sweeps

Inspection requirements are outlined in Section 10.

8. HAZARDOUS MATERIALS (HAZMAT) MANAGEMENT

The Contractor shall be prepared to immediately contain and clean-up spills resulting from fuel or hydraulic fluid leaks. Provisions for HAZMAT management shall be addressed in the Contractor's Storm Water Pollution Prevention Plan (SWPPP). The HAZMAT management procedures shall include, but not be limited to the following:

- Fuel deliveries
- Spill recovery procedures
- Material Safety Data Sheets (MSDS) availability

9. NOTIFICATION OF CONSTRUCTION ACTIVITIES

This section outlines procedures for maintaining communication in the event that airport users and the FAA must be notified immediately of any conditions adversely affecting the operational safety of the airport.

9.1. Contact List

The Contractor shall provide a list of responsible representatives/points of contact for all involved parties, and procedures for contacting each of them, including after hours. The Contractor must have someone available to take emergency calls from the airport operator throughout the entire construction time period. The Contractor's list shall also include the airport point of contact, ATCT (if applicable), and the Engineer to ensure that Contractor personnel have the contacts that they need in the event of a safety related event.

Airport points of contact are as follows:

- Emergency Telephone Number (Police/Fire/Rescue): 911
- Airport Security Office: (540) 797-3093 (24-hour contact)
- Airport Operations: (540) 362-1999 Ext. 277
- ATCT: (540) 265-2280

9.2. NOTAMs

The airport operator shall be responsible for the issuance of all NOTAMs. Only the airport operator may initiate or cancel NOTAMs on airport conditions and is the only entity that can open or close a runway. The airport operator shall coordinate the issuance, maintenance, and cancellation of NOTAMs regarding airport conditions resulting from construction activities with tenants and the Air Traffic Control Tower and provide information on closed or hazardous conditions on airport movement areas to the FAA Flight Service Station (FSS) for issuance of NOTAMs.

9.3. Emergency notification procedures

In the event of an emergency, the Contractor shall call 911. Additional notification procedures will be reviewed at the preconstruction meeting, and periodically at construction progress meetings, and distributed to all appropriate parties.

9.4. Coordination with ARFF

Coordination with ARFF personnel regarding maintenance of access routes, impacts to fire protection water sources, impacts to fire alarm systems, and use of hazardous materials during construction will be addressed at the preconstruction meeting as well as construction progress meetings.

9.5. Notification to the FAA

9.5.1. Part 77. Any proposed construction or alteration of objects that affect navigable airspace, as defined in FAR Part 77, shall be coordinated with the FAA by submitting FAA Form 7460-1, "Notice of Proposed Construction or Alteration" to the appropriate FAA Airports Regional or District Office. This includes construction equipment and proposed parking areas for this equipment (i.e. cranes, graders, and other equipment) on the airport.

9.5.2. NAVAIDS. For emergency (short notice) notification about impacts to both airport-owned and FAA-owned NAVAIDS, the Contractor shall contact the Airport through the emergency contact number and the FAA (540) 362-1999 Ext. 277.

Construction operations that require the shutdown of an airport owned, but FAA maintained NAVAID require a minimum of 45-day notice to the FAA ATO/Technical Operations prior to the shutdown of the facility. A shutdown is defined as more than 24 hours, or more than 4 hours daily.

Any impacts to FAA owned equipment requires a minimum of 45-day notice by the airport operator to the appropriate FAA ATO Service Area Planning and Requirements (P&R) Group.

If the impacts are covered by a Reimbursable Agreement, then they do not have to be reported by the airport operator. If the FAA owned equipment needs to be shutdown, the work must be coordinated with the local ATO/Technical Operations office. This includes any necessary reimbursable agreements and flight checks. Notification of a scheduled shutdown shall be provided seven (7) days prior.

10. INSPECTION REQUIREMENTS

10.1. Daily Inspections

Inspections shall be conducted by the Contractor at least daily to ensure compliance with the CSPP. A sample checklist is provided in Attachment B. In addition, daily inspections will be conducted by the airport operator or their Representative to ensure compliance with the CSPP and the SPCD.

10.2. Final Inspections

A Final Inspection will be conducted by the airport operator, Engineer, FAA, and State upon substantial completion of the project. Applicable flight checks shall be confirmed with the FAA.

11. UNDERGROUND UTILITIES

Special attention shall be given to preventing unscheduled interruption of utility services and facilities. The Contractor shall locate, or arrange for the location of underground utilities, cables, wires, pipelines, and other underground facilities located in excavation areas shall be located. This shall include coordination with public utilities, “One Call” or “Miss Utility” services. FAA ATO/Technical Operations shall be contacted

for location and marking of FAA NAVAID cables. Full coordination between the airport operator's representatives and construction personnel will take place to ensure that these items are protected at all times during construction. If the Contractor damages any active utility during construction, immediate action shall be taken by the Contractor to repair the utility. Refer to Section 9 "Notification of Construction Activities" for contact information.

12. PENALTIES

12.1. Failure on the part of the Contractor to adhere to the requirements of this CSPP, and the plans and specifications, may have consequences that jeopardize the health and safety of persons on or near the construction site. Penalties for such actions are established by the airport operator and may include fines, suspension of construction, and/or removal from the job site. The airport operator reserves the right to deduct fines from money due to the Contractor.

12.2. Unauthorized personnel entering through the Contractor's access point is a violation of this CSPP and may result in a fine. The airport operator reserves the right to deduct fines from money due to the Contractor.

12.3. Contractor personnel found to be beyond the limits of construction without authorization from the Owner are subject to removal from the jobsite and loss of security badge and/or secured area working privileges.

13. SPECIAL CONDITIONS

Special conditions that require safety mitigation action include the following:

- Low-visibility operations
- Snow removal
- Aircraft in distress
- Aircraft accident
- Security breach
- Vehicle/pedestrian deviation (VPD)

During these events the Contractor will be required to suspend operations, clear active construction zones, or other measures as directed by the airport operator. Notification procedures in Section 9 shall be followed. See also Sections 5, “Contractor Access,” and 14, “Runway and Taxiway Visual Aids.”

14. RUNWAY AND TAXIWAY VISUAL AIDS

14.1. General

Those areas where aircraft will be operating shall be clearly marked to separate them from construction areas. Airport markings, lighting, signs, and visual NAVAIDs shall be clearly visible to pilots and not misleading, confusing, or deceptive. This shall be verified throughout the construction of the project. All facilities shall be secured in place to prevent movement by prop wash, jet blast, wing vortices, or other wind currents. The facilities shall be constructed of materials that would minimize damage to an aircraft in the event of inadvertent contact.

14.2. Markings

Temporary markings are required. Refer to the phasing plans (Attachment A) for details on temporary marking for the project.

14.2.1. Temporarily Closed Runways. Temporarily closed runways shall be designated by the placement of an X at each end of the runway directly on or as near as practicable to the runway designation numbers.

14.2.2. Temporarily Closed or New Taxiways. For temporarily closed taxiways or new taxiways prior to opening, an X shall be placed at the entrance to each taxiway as indicated in the phasing plans.

14.3. Lighting and Signage.

Temporary lighting is required. Refer to the phasing plans (Attachment A) for details on temporary lighting for the project.

14.3.1. Temporarily Closed Runways. Temporarily closed runways shall have their lights de-energized or covered, in accordance with the phasing plans.

14.3.2. Temporarily Closed Taxiways. Temporary closed taxiways shall have their lights de-energized or covered. Directional sign panels associated with temporary closed pavements shall be removed and replaced with a blank panel or covered.

15. MARKING AND SIGNS FOR ACCESS ROUTES

Pavement markings and signs for construction personnel shall conform to AC 150/5340-18 on the runway and taxiway. Elsewhere, access route marking and signs shall conform to the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications. Signs adjacent to areas used by aircraft shall comply with the frangibility requirements on AC 150/5220-23, "Frangible Connections." The height of temporary signage shall be restricted so as not to penetrate any avigational surfaces (avigational surfaces are described in the phasing plans in Attachment A). Temporary markings and signage are indicated in the phasing plans.

16. HAZARD MARKING, LIGHTING, AND SIGNAGE

16.1. Purpose

The purpose for delineating work areas is to prevent pilots and other airport personnel who do not belong in the construction area from entering. Work areas will be delineated with closed markers, aviation barricades, and bucket barricades. The first item of work in any work area will be the installation of the necessary closed markers and barricades to isolate the areas of proposed construction. All runway and taxiway closures will be fully coordinated with the airport operator to ensure that the proper NOTAMs are issued.

16.2. Barricades

Barricades are acceptable methods used to identify and define the limits of construction and hazardous areas on airports. The types of barricades allowed are detailed on the phasing plans (Attachment A).

16.3. Lights

Lights shall be red, either steady burning or flashing, and meet the luminance requirements of the State Highway Department. Lights shall be mounted on barricades and spaced at no more than ten (10) feet apart. Lights shall be operated between sunset and sunrise and during periods of low visibility whenever the airport is open for operations.

16.4. Signs

The barricades shall be supplemented with signs (for example “No Entry,” “No Vehicles”) as necessary. Signs shall conform to the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications.

16.5. Air Operations Area – General

Barricades are not permitted in any active safety area. Within a runway or taxiway object free area, and on aprons, the following shall be used to separate all construction/maintenance areas from the movement area:

- Orange traffic cones
- Flashing or steady burning red lights
- Collapsible barricades with diagonal, alternating orange & white stripes
- Signs

All barricades adjacent to an open runway or taxiway / taxilane safety area or apron shall be as low as possible to the ground, and no more than 18 inches high, exclusive of supplementary lights and flags. Barricades shall be of low mass; easily collapsible upon contact with aircraft or any of its components; and weighted or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, or other surface wind currents. Barricades affixed to the surface shall be frangible at grade level or as low as possible, but not to exceed 3 inches above the ground. The types of barricades allowed are detailed on the phasing plans (Attachment A).

16.6. Air Operations Area – Runway / Taxiway Intersections

Highly reflective barricades with lights shall be used to close taxiways leading to closed runways. The types of barricades allowed are detailed on the phasing plans (Attachment A).

16.7. Air Operations Area – Other

For areas outside runway and taxiway object free areas and safety areas and aprons, barricades intended for construction vehicles and personnel may consist of different shapes and may be constructed from various materials, including railroad ties, sawhorses, jersey barriers, or barrels. The Contractor shall coordinate these barricades, and their locations with the airport operator’s representative.

16.8. Maintenance

The construction specifications include a provision requiring the Contractor to have personnel on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades.

Refer to the phasing plans in Attachment A for graphical depictions of hazard marking, lighting, and signage.

17. PROTECTION OF RUNWAY AND TAXIWAY SAFETY AREAS

17.1. Runway Safety Area. Construction activities within the existing RSA are subject to the following conditions:

17.1.1. No activity is permitted while the runway is open for aircraft operations. Reference is directed to Section 5 for information on Contractor access to runway safety areas.

17.1.2. For this project, the following distances (in accordance with FAA Advisory Circular 150/5300-13), must be protected along the runway edges:

Runway	Aircraft Approach Category A, B, C, or D	Airplane Design Group I, II, III, or IV	RSA Width in Feet Divided by 2
6	C	IV	250
24	C	IV	250
16	C	IV	250
34	C	IV	250

17.1.3. For this project, the following distances (in accordance with FAA Advisory Circular 150/5300-13), must be protected before the runway threshold:

Runway End Number	Airplane Design Group I, II, III, or IV	Aircraft Approach Category A, B, C, or D	Minimum Safety Area Prior to the Threshold	Minimum Distance to Threshold Based on Required Approach Slope	
6	IV	C	600	1,000 ft	34:1
24	IV	C	600	1,000 ft	34:1
16	IV	C	600	1,000 ft	34:1
34	IV	C	600	1,000 ft	34:1

17.2. Runway Object Free Area (ROFA)

Construction, including excavations, may be permitted in the ROFA only if performed in accordance with the requirements in the phasing plans (Attachment A). Equipment must be removed from the ROFA when not in use, and material shall not be stockpiled in the ROFA if not necessary. Stockpiling material in the OFA shall not occur until a 7460-1 form and justification is provided to the appropriate FAA Airports Regional or District Office and approved. ROFA dimensions shall be as identified in the following table, which is in accordance with FAA Advisory Circular 150/5300-13.

Runway	ROFA Distance from Centerline (ft)	ROFA Width (ft)	ROFA Length from End of Runway (ft)
6	400	800	1000
24	400	800	1000
16	400	800	1000
34	400	800	1000

17.3. Taxiway Safety Area (TSA)

17.3.1. No construction is permitted within the taxiway safety area while the taxiway is open for aircraft operations.

17.3.2. For this project, the following distances (in accordance with FAA Advisory Circular 150/5300-13) must be protected along the taxiway edges:

Taxiway	Aircraft Approach Category A, B, C, or D	Airplane Design Group I, II, III, or IV	TSA Width in Feet Divided by 2
All taxiways	C	IV	85.5

17.4. Taxiway Object Free Area (TOFA)

No work is permitted inside the TOFA without the taxiway being closed. For this project, the following distances (in accordance with FAA Advisory Circular 150/5300-13) must be protected along the taxiway:

Taxiway	Aircraft Approach Category A, B, C, or D	Airplane Design Group I, II, III, or IV	TOFA Width in Feet Divided by 2
All taxiways	C	IV	121.5

17.5. Obstacle Free Zone (OFZ)

Typically, no personnel, equipment, or material shall be permitted inside the OFZ while the runway is open for aircraft operations. If access is required, the express permission of the airport operator shall be obtained. Any request for such permission shall be submitted in writing by the Contractor, along with justification in order for the owner to coordinate the request with FAA. The Runway OFZ is the airspace above the runway whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. For this project, the OFZ dimensions (in accordance with FAA Advisory Circular 150/5300-13) are as follows:

Runway	OFZ Distance from Centerline (ft)	OFZ Width (ft)	OFZ Length from End of Runway (ft)
6	200	400	200
24	200	400	200
16	200	400	200
34	200	400	200

17.6. Runway Approach/ Departure Areas and Clearways

All personnel, equipment, and material shall remain outside the protected approaches and surfaces as shown on the phasing plans in Attachment A. Objects that do not penetrate these surfaces may still be obstructions to air navigation and may affect standard instrument approach procedures. Prior to placing such objects, a 7460-1 form and justification must be provided to the appropriate FAA Airports Regional or District Office and approved. Particular attention is called to the placement of cranes, excavators, and other tall equipment.

18. OTHER LIMITATIONS ON CONSTRUCTION

18.1. Prohibitions.

The following are prohibited:

18.1.1. No use of tall equipment (cranes, concrete pumps, etc.) unless a 7460-1 determination letter is issued for such equipment.

18.1.2. No uses of open flame welding or torches unless fire safety precautions are provided, and the airport operator has approved their use.

18.1.3. No use of electrical blasting caps on or within 1,000 feet (300 meters) of the airport property.

18.1.4. No use of flare pots within the AOA.

18.2. Restrictions.

The following are restricted:

18.2.1. Activities during special condition events as outlined in Section 13.

18.2.2. Areas that cannot be worked on simultaneously as outlined in the phasing plans. Also refer to Section 2, "Phasing."

18.2.3. Day or night construction restrictions as outlined in the phasing plans. Also refer to Section 2, "Phasing."

18.2.4. Work area restrictions as outlined in the phasing plans. Also refer to Section 2, "Phasing."

ATTACHMENT A – PHASING PLANS



(Bid Set - see Work Area Milestone Plan Sheets)

ATTACHMENT B – SAMPLE CHECKLISTS FROM AC 150/5370-2G



APPENDIX C. SAFETY AND PHASING PLAN CHECKLIST

This appendix is keyed to Chapter 2. In the electronic version of this AC, clicking on the paragraph designation in the Reference column will access the applicable paragraph. There may be instances where the CSPP requires provisions that are not covered by the list in this appendix.

This checklist is intended as an aid, not a required submittal.

Table C-1. CSPP Checklist

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
General Considerations					
Requirements for predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction are specified.	<u>2.5</u>				
Operational safety is a standing agenda item for construction progress meetings.	<u>2.5</u>				
Scheduling of the construction phases is properly addressed.	<u>2.6</u>				
Any formal agreements are established.	<u>2.5.3</u>				
Areas and Operations Affected by Construction Activity					
Drawings showing affected areas are included.	<u>2.7.1</u>				
Closed or partially closed runways, taxiways, and aprons are depicted on drawings.	<u>2.7.1.1</u>				
Access routes used by ARFF vehicles affected by the project are addressed.	<u>2.7.1.2</u>				
Access routes used by airport and airline support vehicles affected by the project are addressed.	<u>2.7.1.3</u>				
Underground utilities, including water supplies for firefighting and drainage.	<u>2.7.1.4</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Approach/departure surfaces affected by heights of temporary objects are addressed.	<u>2.7.1.5</u>				
Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads are properly depicted on drawings.	<u>2.7.1</u>				
Temporary changes to taxi operations are addressed.	<u>2.7.2.1</u>				
Detours for ARFF and other airport vehicles are identified.	<u>2.7.2.2</u>				
Maintenance of essential utilities and underground infrastructure is addressed.	<u>2.7.2.3</u>				
Temporary changes to air traffic control procedures are addressed.	<u>2.7.2.4</u>				
NAVAIDs					
Critical areas for NAVAIDs are depicted on drawings.	<u>2.8</u>				
Effects of construction activity on the performance of NAVAIDS, including unanticipated power outages, are addressed.	<u>2.8</u>				
Protection of NAVAID facilities is addressed.	<u>2.8</u>				
The required distance and direction from each NAVAID to any construction activity is depicted on drawings.	<u>2.8</u>				
Procedures for coordination with FAA ATO/Technical Operations, including identification of points of contact, are included.	<u>2.8, 2.13.1, 2.13.5.3.1, 2.18.1</u>				
Contractor Access					
The CSPP addresses areas to which contractor will have access and how the areas will be accessed.	<u>2.9</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
The application of 49 CFR Part 1542 Airport Security, where appropriate, is addressed.	<u>2.9</u>				
The location of stockpiled construction materials is depicted on drawings.	<u>2.9.1</u>				
The requirement for stockpiles in the ROFA to be approved by FAA is included.	<u>2.9.1</u>				
Requirements for proper stockpiling of materials are included.	<u>2.9.1</u>				
Construction site parking is addressed.	<u>2.9.2.1</u>				
Construction equipment parking is addressed.	<u>2.9.2.2</u>				
Access and haul roads are addressed.	<u>2.9.2.3</u>				
A requirement for marking and lighting of vehicles to comply with <u>AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport</u> , is included.	<u>2.9.2.4</u>				
Proper vehicle operations, including requirements for escorts, are described.	<u>2.9.2.5, 2.9.2.6</u>				
Training requirements for vehicle drivers are addressed.	<u>2.9.2.7</u>				
Two-way radio communications procedures are described.	<u>2.9.2.9</u>				
Maintenance of the secured area of the airport is addressed.	<u>2.9.2.10</u>				
Wildlife Management					
The airport operator's wildlife management procedures are addressed.	<u>2.10</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Foreign Object Debris Management					
The airport operator’s FOD management procedures are addressed.	<u>2.11</u>				
Hazardous Materials Management					
The airport operator’s hazardous materials management procedures are addressed.	<u>2.12</u>				
Notification of Construction Activities					
Procedures for the immediate notification of airport user and local FAA of any conditions adversely affecting the operational safety of the airport are detailed.	<u>2.13</u>				
Maintenance of a list by the airport operator of the responsible representatives/points of contact for all involved parties and procedures for contacting them 24 hours a day, seven days a week is specified.	<u>2.13.1</u>				
A list of local ATO/Technical Operations personnel is included.	<u>2.13.1</u>				
A list of ATCT managers on duty is included.	<u>2.13.1</u>				
A list of authorized representatives to the OCC is included.	<u>2.13.2</u>				
Procedures for coordinating, issuing, maintaining and cancelling by the airport operator of NOTAMS about airport conditions resulting from construction are included.	<u>2.8, 2.13.2, 2.18.3.3.9</u>				
Provision of information on closed or hazardous conditions on airport movement areas by the airport operator to the OCC is specified.	<u>2.13.2</u>				
Emergency notification procedures for medical, fire fighting, and police response are addressed.	<u>2.13.3</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Coordination with ARFF personnel for non-emergency issues is addressed.	<u>2.13.4</u>				
Notification to the FAA under 14 CFR parts 77 and 157 is addressed.	<u>2.13.5</u>				
Reimbursable agreements for flight checks and/or design and construction for FAA owned NAVAIDs are addressed.	<u>2.13.5.3.2</u>				
Inspection Requirements					
Daily and interim inspections by both the airport operator and contractor are specified.	<u>2.14.1, 2.14.2</u>				
Final inspections at certificated airports are specified when required.	<u>2.14.3</u>				
Underground Utilities					
Procedures for protecting existing underground facilities in excavation areas are described.	<u>2.15</u>				
Penalties					
Penalty provisions for noncompliance with airport rules and regulations and the safety plans are detailed.	<u>2.16</u>				
Special Conditions					
Any special conditions that affect the operation of the airport or require the activation of any special procedures are addressed.	<u>2.17</u>				
Runway and Taxiway Visual Aids - Marking, Lighting, Signs, and Visual NAVAIDs					
The proper securing of temporary airport markings, lighting, signs, and visual NAVAIDs is addressed.	<u>2.18.1</u>				
Frangibility of airport markings, lighting, signs, and visual NAVAIDs is specified.	<u>2.18.1, 2.18.3, 2.18.4.2, 2.20.2.4</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
The requirement for markings to be in compliance with <u>AC 150/5340-1</u> , <i>Standards for Airport Markings</i> , is specified.	<u>2.18.2</u>				
Detailed specifications for materials and methods for temporary markings are provided.	<u>2.18.2</u>				
The requirement for lighting to conform to <u>AC 150/5340-30</u> , <i>Design and Installation Details for Airport Visual Aids</i> ; <u>AC 150/5345-50</u> , <i>Specification for Portable Runway and Taxiway Lights</i> ; and <u>AC 150/5345-53</u> , <i>Airport Lighting Certification Program</i> , is specified.	<u>2.18.3</u>				
The use of a lighted X is specified where appropriate.	<u>2.18.2.1.2</u> , <u>2.18.3.2</u>				
The requirement for signs to conform to <u>AC 150/5345-44</u> , <i>Specification for Runway and Taxiway Signs</i> ; <u>AC 150/5340-18</u> , <i>Standards for Airport Sign Systems</i> ; and <u>AC 150/5345-53</u> , <i>Airport Lighting Certification Program</i> , is specified.	<u>2.18.4</u>				
Marking and Signs For Access Routes					
The CSPP specifies that pavement markings and signs intended for construction personnel should conform to <u>AC 150/5340-18</u> and, to the extent practicable, with the MUTCD and/or State highway specifications.	<u>2.18.4.2</u>				
Hazard Marking and Lighting					
Prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles are specified.	<u>2.20.1</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Hazard marking and lighting are specified to identify open manholes, small areas under repair, stockpiled material, and waste areas.	<u>2.20.1</u>				
The CSPP considers less obvious construction-related hazards.	<u>2.20.1</u>				
Equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast is specified.	<u>2.20.2.1</u>				
The spacing of barricades is specified such that a breach is physically prevented barring a deliberate act.	<u>2.20.2.1</u>				
Red lights meeting the luminance requirements of the State Highway Department are specified.	<u>2.20.2.2</u>				
Barricades, temporary markers, and other objects placed and left in areas adjacent to any open runway, taxiway, taxi lane, or apron are specified to be as low as possible to the ground, and no more than 18 inch high.	<u>2.20.2.3</u>				
Barricades are specified to indicate construction locations in which no part of an aircraft may enter.	<u>2.20.2.3</u>				
Highly reflective barriers with lights are specified to barricade taxiways leading to closed runways.	<u>2.20.2.5</u>				
Markings for temporary closures are specified.	<u>2.20.2.5</u>				
The provision of a contractor's representative on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades is specified.	<u>2.20.2.7</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
Work Zone Lighting for Nighttime Construction					
If work is to be conducted at night, the CSPP identifies construction lighting units and their general locations and aiming in relationship to the ATCT and active runways and taxiways.	<u>2.21</u>				
Protection of Runway and Taxiway Safety Areas					
The CSPP clearly states that no construction may occur within a safety area while the associated runway or taxiway is open for aircraft operations.	<u>2.22.1.1</u> , <u>2.22.3.1</u>				
The CSPP specifies that the airport operator coordinates the adjustment of RSA or TSA dimensions with the ATCT and the appropriate FAA Airports Regional or District Office and issues a local NOTAM.	<u>2.22.1.2</u> , <u>2.22.3.2</u>				
Procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations, are detailed.	<u>2.22.3.3</u>				
The CSPP specifies that open trenches or excavations are not permitted within a safety area while the associated runway or taxiway is open, subject to approved exceptions.	<u>2.22.1.4</u>				
Appropriate covering of excavations in the RSA or TSA that cannot be backfilled before the associated runway or taxiway is open is detailed.	<u>2.22.1.4</u>				
The CSPP includes provisions for prominent marking of open trenches and excavations at the construction site.	<u>2.22.1.4</u>				
Grading and soil erosion control to maintain RSA/TSA standards are addressed.	<u>2.22.3.5</u>				

Coordination	Reference	Addressed?			Remarks
		Yes	No	NA	
The CSPP specifies that equipment is to be removed from the ROFA when not in use.	<u>2.22.2</u>				
The CSPP clearly states that no construction may occur within a taxiway safety area while the taxiway is open for aircraft operations.	<u>2.22.3</u>				
Appropriate details are specified for any construction work to be accomplished in a taxiway object free area.	<u>2.22.4</u>				
Measures to ensure that personnel, material, and/or equipment do not penetrate the OFZ or threshold siting surfaces while the runway is open for aircraft operations are included.	<u>2.22.4.3.6</u>				
Provisions for protection of runway approach/departure areas and clearways are included.	<u>2.22.6</u>				
Other Limitations on Construction					
The CSPP prohibits the use of open flame welding or torches unless adequate fire safety precautions are provided and the airport operator has approved their use.	<u>2.23.1.2</u>				
The CSPP prohibits the use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.	<u>2.23.1.3</u>				

APPENDIX D. CONSTRUCTION PROJECT DAILY SAFETY INSPECTION CHECKLIST

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the airport operator or contractor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriate for each project including information such as the date, time and name of the person conducting the inspection.

Table D-1. Potentially Hazardous Conditions

Item	Action Required (Describe)	No Action Required (Check)
Excavation adjacent to runways, taxiways, and aprons improperly backfilled.		
Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking.		
Runway resurfacing projects resulting in lips exceeding 3 inch (7.6 cm) from pavement edges and ends.		
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.		
Equipment or material near NAVAIDs that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.		
Tall and especially relatively low visibility units (that is, equipment with slim profiles) — cranes, drills, and similar objects — located in critical areas, such as OFZ and		

Item	Action Required (Describe)	No Action Required (Check)
approach zones.		
Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on any apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area.		
Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.		
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.		
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.		
Wildlife attractants — such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water — on or near airports.		
Obliterated or faded temporary markings on active operational areas.		
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.		

Item	Action Required (Describe)	No Action Required (Check)
Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.		
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway / taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services; and/or loss of communications.		
Restrictions on ARFF access from fire stations to the runway / taxiway system or airport buildings.		
Lack of radio communications with construction vehicles in airport movement areas.		
Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircraft operations.		
Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.		
Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.		
Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).		

Item	Action Required (Describe)	No Action Required (Check)
Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits.		
Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.		
Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.		
Site burning, which can cause possible obscuration.		
Construction work taking place outside of designated work areas and out of phase.		

Appendix C - Geotechnical Report

**PRELIMINARY GEOTECHNICAL
ENGINEERING REPORT**
Runway 6/24 Rehabilitation
Roanoke-Blacksburg Regional Airport (ROA)
Roanoke, Virginia

Schnabel Reference #23160097.000
June 17, 2024

June 17, 2024

Mr. William Eschenfelder, PE
Delta Airport Consultants, Inc.
2700 Polo Parkway
Midlothian, Virginia 23113

Subject: Preliminary Geotechnical Engineering Report, Runway 6/24 Rehabilitation, Roanoke-Blacksburg Regional Airport (ROA), Roanoke, Virginia (Schnabel Reference 23160097.000)

Dear Mr. Eschenfelder:

SCHNABEL ENGINEERING, LLC (Schnabel) is pleased to submit our preliminary geotechnical engineering report for this project. We provided these services in accordance with our proposal dated October 12, 2023 and per our Subconsultant Agreement with Delta Airport Consultants, Inc. dated January 31, 2024.

PROJECT DESCRIPTION

The Roanoke Regional Airport Commission is planning to rehabilitate the primary runway at the Roanoke-Blacksburg regional Airport (ROA) in Roanoke, Virginia. The 6,800 linear foot long 150 ft wide runway, designated Runway 6/24, is asphalt-paved. The Roanoke Regional Airport Commission has retained the services of Delta to assess the condition of Runway 6/24 and to perform a preliminary design of runway rehabilitation alternatives.

GEOLOGIC SETTING

Our research of available records and experience in the Roanoke Valley indicate that the Roanoke-Blacksburg Regional Airport lies within the Valley and Ridge Physiographic Province and is underlain primarily by carbonate rock of the Elbrook formation. Rocks of this formation are known to be susceptible to karst features such as ground subsidence, sinkholes, shallow bedrock pinnacles adjacent to deep bedrock valleys, shallow boulders, and zones of extremely soft soil. Ground subsidence caused by the dissolution of carbonate rock and subsequent loss of soil is referred to as karstic activity, or karst. Sinkholes are present in the vicinity of the airport and highly variable depth to bedrock and zones of soft to very soft soil are common.

SUBSURFACE EXPLORATION PROGRAM

We performed a subsurface exploration program along Runway 6/24 between March 28 and April 14, 2024. A total of 20 standard penetration test (SPT) borings were drilled by Blue Ridge Drilling, Roanoke,

Virginia at locations selected by Applied Pavement Technologies, Inc. (APT). All borings were drilled under the observation of Schnabel Engineering, LLC personnel. Borings were performed in accordance with ASTM D 1586. Approximate test boring locations are shown on the Test Boring Location Plans included at the end of this report. Boring locations indicated on the plans are approximate based on information provided by APT. The boring elevations are coincident with the top of pavement grade at the locations drilled. Borings were backfilled with auger cuttings and pavements were patched with concrete.

The SPT samples were obtained using a hydraulically driven automatic trip hammer (ATH). Most correlations with SPT data are based on N-values collected with a safety hammer. The energy applied to the split-spoon sampler using the ATH is about 30 percent greater than that applied using the safety hammer, resulting in lower N-values. The hammer blows shown on the boring logs are uncorrected for the higher energy. However, we correct SPT N-values for the higher energy when using N-values in our description of soil consistency.

All 20 of the borings were drilled in existing pavement. The pavement at each boring was cored using a 7-inch diameter core barrel advanced with the drill rig. We retrieved the cores from the holes and returned them to our office for measurement and photographic documentation. The boring logs are included in Appendix A along with photographic logs of each pavement core. A summary of pavement section thicknesses recorded at the test boring locations is summarized below.

Table 1 – Pavement Section Thicknesses

Boring No.	Asphalt Thickness (in)	Depth of Laminations (in)	Cement-Treated Aggregate Thickness (in)	Stone Base Thickness (in)	Total Pavement Section Thickness (in)
B-1	17.5	12.0	NA	7	24.5
B-2	18.0	2.75, 12.5	NA	7.5	25.5
B-3	18.0	5.0	NA	2.0*	20.0
B-4	12.0	NA	NA	3.0*	15.0
B-5	16.25	NA	NA	3.0*	19.25
B-6	18.5	4.4	NA	2.5*	21.0
B-7	11.0	NA	NA	9.5	20.5
B-8	12.0	NA	NA	13.0	25.0
B-9	12.5	NA	NA	22.3	34.8
B-10	17.0	11.0	NA	4.5	21.5
B-11	10.25	NA	NA	3.25*, 4.5	18.0
B-12	14.75	NA	NA	2.5*, 6.5	23.75
B-13	9.5	1.75	NA	4.0*, 7.5	21.0
B-14	10.25	NA	NA	3.25*, 6.5	20.0
B-15	9.25	2.4	NA	5.25*, 6.0	20.5
B-16	13.5	NA	NA	2.5*, 5.0	21.0
B-17	14.0	NA	NA	3.0*, 7.0	24.0
B-18	8.5	NA	7.5	6.0	22.0
B-19	8.25	2.75	9.5	6.0	23.75
B-20	8.5	NA	7.0	6.0	21.5

*Open-graded ballast-sized aggregate stone

The condition of the pavement sections we encountered in the borings was generally good. Laminations were observed in eight of the cores, at depths ranging from 1.75 to 12.0 inches. Asphalt pavement thicknesses recorded ranged from 8.25 inches in Boring B-19 to 18.0 inches in Borings B-2 and B-3. The asphalt appeared to be well consolidated and evenly mixed. Cement Treated Aggregate (CTA) was encountered beneath the asphalt pavement in Borings B-18, B-19, and B-20, drilled at the northeast end of the runway. The CTA is in excellent condition, strongly resembling cast-in-place concrete. The thickness of the CTA layer ranged from 7.0 to 9.5 inches. The composition of the CTA appeared uniform and well compacted. The underlying base stone consisted of either open-graded ballast-size aggregate stone and/or dense-graded aggregate. Measured aggregate layer thicknesses generally varied from about 2.0 to 13.0 inches. An anomalously large amount of dense-graded aggregate stone (22.3 inches thick) was encountered beneath the asphalt pavement in Boring B-9.

Soil Laboratory Testing

Our laboratory performed tests on jar and bulk soil samples collected during the subsurface exploration. The testing aided in the classification of materials encountered in the subsurface exploration. The results of the laboratory tests are included in Appendix B and are summarized for each stratum in the *Subsurface Conditions* section of this report. Selected test results are also shown on the boring logs in Appendix A.

Index Testing

We performed index testing on samples collected as part of the exploration to provide soil classifications and to provide parameters for use with published correlations with soil properties. Index testing included performing natural moisture content on 50 jar samples along with Atterberg Limit and gradation tests on ten bulk samples of soil representing Strata A and B.

Compaction and California Bearing Ratio (CBR) Testing

We performed Modified Proctor compaction and CBR testing on ten samples representing Strata A and B to evaluate compaction characteristics and to provide soil parameters for pavement design. Reported CBR values represent the 0.1 in. penetration value corrected for concavity, as applicable. We suspect that the presence of lime may have contributed to the anomalously high CBR value of 40.8 for B-19 and the modestly high CBR value of 16.7 for B-20. Table 2 summarizes the compaction and CBR testing results.

Table 2 – Soil Laboratory Compaction and CBR Test Results

Boring	Depth (ft)	USCS Classification	Max. Dry Density (pcf)	Optimum Moisture (%)	Corrected Max. Dry Density (pcf)	Corrected Optimum Moisture (%)	CBR	Percent Swell
B-3	2-12	CH	107.0	20.4	NA	NA	7.8	3.4
B-4	2-12	CH	106.3	20.4	NA	NA	3.7	8.3
B-5	2-12	CH	117.2	15.4	NA	NA	8.3	3.8
B-6	2-6.5	CH	111.7	15.0	NA	NA	6.8	3.7
B-8	2-12	MH	119.3	13.7	NA	NA	9.6	3.0
B-11	2-12	CH	108.2	19.2	NA	NA	12.9	1.4
B-13	2-12	CH	110.8	18.0	113.5	16.9	5.4	5.0
B-16	2-12	CH	120.2	14.6	NA	NA	27.2	0.5
B-19	2-12	CH	108.7	19.1	NA	NA	40.8	1.2
B-20	2-12	CH	111.4	17.9	NA	NA	16.7	2.0

In Advisory Circular No. 150/5320-6G, Paragraph 2.3.9.4, the Federal Aviation Administration (FAA) “recommends selecting a subgrade strength value for design that is one standard deviation (sample) below the mean of the laboratory tests.” The arithmetic mean for the ten CBR results is 13.9 and the standard deviation is 11.7. Using the FAA recommendation of selecting a CBR value equal to one standard deviation below the mean results in a design CBR value of 2.3. It is our opinion that this value is anomalously low and is not representative of the long-term strength of the subgrade soils beneath the runway. The standard deviation is disproportionately affected by the anomalously high (40.8) and low (3.7) CBR values from B-19 and B-4. Consequently, we recommend removing these two values from the mean and standard deviation calculations. The mean and standard deviation values of the remaining eight samples are 11.8 and 7.2, respectively. The mean less one standard deviation is 4.6. Based on our experience and Virginia Department of Transportation (VDOT) guidelines, this is generally representative of the design CBR value for typical soils in the Roanoke Valley. Therefore, for the Runway 6/24 rehabilitation, we recommend using a design CBR of 4.6.

SUBSURFACE CONDITIONS

The following subsurface stratigraphy is based on the data collected during our subsurface exploration. We have characterized the following generalized subsurface soils stratigraphy based on the boring data presented in Appendix A.

Surface Cover

All of the borings were drilled through existing runway pavements. The thickness of asphalt, Cement-Treated Aggregate (CTA), and base stone (open graded ballast-sized aggregate stone and/or dense graded aggregate) ranged from 1.3 at Boring B-4 to 2.9 ft at Boring B-9. Photographic logs of the asphalt cores are included in Appendix A.

Stratum A: Existing Fill

We encountered existing fill, likely associated with the original runway construction, in all but two of the borings beneath the runway pavement section (asphalt, CTA, and stone base course) to depths ranging from 2.5 to 12 ft, the maximum depth explored in the borings. In Boring B-1, we recorded auger refusal on suspected surge stone within the fill at a depth of 3.5 ft. A majority of the fill soils classified as Silt (ML), Fat Clay (CH), and Elastic Silt (MH), with varying amounts of sand and gravel. As previously discussed, we observed evidence of lime stabilization within the fill stratum in samples recovered from Borings B-17, B-18, B-19, and B-20. Lime was observed in the upper portions of Stratum A in these borings, generally at shallow depths beneath the bottom of the pavement section. Standard Penetration Test N-values in Stratum A typically varied from 4 to 22, indicating firm to very stiff consistency. We recorded substantially higher N-values, varying from 24 to 63, in Borings B-18, B-19, and B-20 where lime was observed. N-values in the upper portion of Boring B-17 where lime was observed were 11 and 15.

Stratum B: Residual

Residual soil consists of material derived from weathering of the underlying bedrock. Residual soils commonly retain the structure of the parent bedrock. We encountered residual soils in 15 of the 20 borings. Stratum B was encountered beneath the pavement in Borings B-3 and B-6, and beneath Stratum A fill in the other 13 borings to depths of 6.4 to 12 ft, the maximum depth explored in the borings. The residual soils generally classified as Fat Clay (CH), Elastic Silt (MH), and Silt (ML). The residual soils contained varying amounts of sand and gravel. N-values recorded in Stratum B ranged from 4 to 29, indicating generally firm to very stiff consistency.

Stratum C: Disintegrated Rock

Disintegrated rock is a weathered gradational zone between the overlying residual soils and the underlying bedrock. We encountered a thin layer of disintegrated rock materials beneath the Stratum B residual soils in Borings B-6 and B-7. Stratum C in these borings was only about 2 to 3 inches thick. We encountered auger refusal on rock at depths of 6.6 and 6.7 ft in these borings. The disintegrated rock materials classified as Sandy Silt with Gravel (ML). N-values of 50/1" and 50/2" were recorded in Stratum C.

Groundwater

We did not observe groundwater during drilling, upon completion, or immediately prior to backfilling any of the borings to the depths explored. The test boring logs in Appendix A include groundwater observations obtained during our subsurface exploration. These data include depths to groundwater encountered during drilling, upon drilling completion, and following completion of the boring. We did not obtain long-term water level readings since we backfilled the test borings upon completion for safety.

The groundwater levels on the logs indicate our estimate of the hydrostatic water table at the time of our subsurface exploration. The final design should anticipate the fluctuation of the hydrostatic water table depending on variations in precipitation, surface runoff, pumping, evaporation, leaking utilities, and similar factors.

Delta Airport Consultants, Inc.

Runway 6/24 Rehabilitation – Preliminary Geotechnical Engineering Report

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or other instrument of service.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

SCHNABEL ENGINEERING, LLC



Steven J. Winter, PE
Principal

SJW:rl

Figure

Appendix A: Subsurface Exploration Data

Appendix B: Laboratory Test Data

Distribution:

Delta Airport Consultants, Inc.

Attn: William Eschenfelder, PE
Kate DeJarnette, ACE

FIGURES

Figures 1, 2, and 3: Test Boring Location Plans







APPENDIX A

SUBSURFACE EXPLORATION DATA

Subsurface Exploration Procedures

General Notes for Subsurface Exploration Logs

Identification of Soil

Boring Logs, B-1 through B-20

Asphalt Core Photographic Logs (20)

SUBSURFACE EXPLORATION PROCEDURES

Test Borings – Hollow Stem Augers

Asphalt pavements are cored using a 7-inch diameter diamond-bit core barrel advanced with the drill rig. The borings are advanced by turning a continuous flight auger with a center opening of 2¼ or 3¼ inches. A plug device blocks off the center opening while augers are advanced. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger, by standard methods, after removal of the plug. Usually, no water is introduced into the boring using this procedure. A 6-inch diameter core drill attachment was used to advance the borings through the asphalt pavement.

Standard Penetration Test Results

The numbers in the Sampling Data column of the boring logs represent Standard Penetration Test (SPT) results. Each number represents the blows needed to drive a 2-inch O.D., 1⅝-inch I.D. split-spoon sampler 6 inches, using a 140-pound hammer falling 30 inches. The sampler is typically driven a total of 18 or 24 inches. The first 6 inches are considered a seating interval. The total of the number of blows for the second and third 6-inch intervals is the SPT “N-value.” The SPT is performed according to ASTM D1586.

The SPT samples were obtained using a hydraulically driven automatic trip hammer (ATH). Most correlations with SPT data are based on N-values collected with a safety hammer. The energy applied to the split-spoon sampler using the ATH is about 30 percent greater than that applied using the safety hammer, resulting in lower N-values. The hammer blows shown on the boring logs are uncorrected for the higher energy. However, we correct SPT N-values for the higher energy when using N-values in our description of soil density and consistency.

Soil Classification Criteria

The group symbols on the logs represent the Unified Soil Classification System Group Symbols (ASTM D2487) based on visual observation and limited laboratory testing of the samples. Criteria for visual identification of soil samples are included in this appendix. Some variation can be expected between samples visually classified and samples classified in the laboratory.

Residual soils are derived through the in-place physical and chemical weathering of the underlying rock. Disintegrated rock is defined as residual material with SPT N-values between 60 blows per foot and refusal. Refusal is defined as an N-value of 50 blows for a penetration of one inch or less.

Boring Locations and Elevations

Approximate boring locations are shown on Figures 1, 2, and 3. Locations were selected by Applied Pavement Technologies, Inc. Ground surface elevations were not available. The grade at the tops of borings are coincident with the top of pavement grade at all of the boring locations. Boring locations should be considered no more accurate than the methods used to determine them.

GENERAL NOTES FOR SUBSURFACE EXPLORATION LOGS

1. Numbers in sampling data column next to Standard Penetration Test (SPT) symbols indicate blows required to drive a 2-inch O.D., 1½-inch I.D. sampling spoon 6 inches using a 140 pound hammer falling 30 inches. The Standard Penetration Test (SPT) N-value is the number of blows required to drive the sampler 12 inches, after a 6 inch seating interval. The Standard Penetration Test is performed in general accordance with ASTM D1586.
2. Visual classification of soil is in accordance with terminology set forth in "Identification of Soil." The ASTM D2487 group symbols (e.g., CL) shown in the classification column are based on visual observations.
3. Estimated water levels indicated on the logs are only estimates from available data and may vary with precipitation, porosity of the soil, site topography, and other factors.
4. Refusal at the surface of rock, boulder, or other obstruction is defined as an SPT resistance of 50 blows for 1 inch or less of penetration.
5. The logs and related information depict subsurface conditions only at the specific locations and at the particular time when drilled or excavated. Soil conditions at other locations may differ from conditions occurring at these locations. Also, the passage of time may result in a change in the subsurface soil and water level conditions at the subsurface exploration location.
6. The stratification lines represent the approximate boundary between soil and rock types as obtained from the subsurface exploration. Some variation may also be expected vertically between samples taken. The soil profile, water level observations and penetration resistances presented on these logs have been made with reasonable care and accuracy and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.
7. Key to symbols and abbreviations:



S-1, SPT
5+10+1

Sample No., Standard Penetration Test
Number of blows in each 6-inch increment

LL	Liquid Limit
MC	Moisture Content (percent)
PL	Plastic Limit
PP	Pocket Penetrometer Reading (tsf)
%Passing#200	Percent by weight passing a No. 200 Sieve

IDENTIFICATION OF SOIL

I. DEFINITION OF SOIL GROUP NAMES (ASTM D2487)

DEFINITION OF SOIL GROUP NAMES (ASTM D2487)			SYMBOL	GROUP NAME
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels – More than 50% of coarse fraction retained on No. 4 sieve Coarse, ¾" to 3" Fine, No. 4 to ¾"	Clean Gravels Less than 5% fines	GW	WELL GRADED GRAVEL
			GP	POORLY GRADED GRAVEL
		Gravels with fines More than 12% fines	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	Sands – 50% or more of coarse Fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW	WELL GRADED SAND
			SP	POORLY GRADED SAND
		Sands with fines More than 12% fines	SM	SILTY SAND
			SC	CLAYEY SAND
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays – Liquid Limit less than 50 Low to medium plasticity	Inorganic	CL	LEAN CLAY
			ML	SILT
		Organic	OL	ORGANIC CLAY
				ORGANIC SILT
	Silts and Clays – Liquid Limit 50 or more Medium to high plasticity	Inorganic	CH	FAT CLAY
			MH	ELASTIC SILT
		Organic	OH	ORGANIC CLAY
				ORGANIC SILT
Highly Organic Soils	Primarily organic matter, dark in color and organic odor		PT	PEAT

II. DEFINITION OF SOIL COMPONENT PROPORTIONS (ASTM D2487)

Examples

Adjective Form	GRAVELLY SANDY	>30% to <50% coarse grained component in a fine-grained soil	GRAVELLY LEAN CLAY
	CLAYEY SILTY	>12% to <50% fine grained component in a coarse-grained soil	SILTY SAND
"With"	WITH GRAVEL WITH SAND	>15% to <30% coarse grained component in a fine-grained soil	FAT CLAY WITH GRAVEL
	WITH GRAVEL WITH SAND	>15% to <50% coarse grained component in a coarse-grained soil	POORLY GRADED GRAVEL WITH SAND
	WITH SILT WITH CLAY	>5% to <12% fine grained component in a coarse-grained soil	POORLY GRADED SAND WITH SILT

III. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS	Unified Soil Classification Symbols are shown above as group symbols. A dual symbol "-" indicates the soil belongs to two groups. A borderline symbol "/" indicates the soil belongs to two possible groups.
FILL	Man-made deposit containing soil, rock and often foreign matter.
DISINTEGRATED ROCK (DR)	Residual materials with a standard penetration resistance (SPT) between 60 blows per foot and refusal. Refusal is defined as an SPT of 100 blows for 2" or less penetration.
BOULDERS & COBBLES	Boulders are considered rounded pieces of rock larger than 12 inches, while cobbles range from 3 to 12-inch size.
LENSES	0 to ½-inch seam within a material in a test pit.
LAYERS	½ to 12-inch seam within a material in a test pit.
POCKET	Discontinuous body within a material in a test pit.
MOISTURE CONDITIONS	Wet, moist or dry to indicate visual appearance of specimen.
COLOR	Overall color, with modifiers such as light to dark or variation in coloration.



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-1**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/29/24 **Finished:** 3/29/24
Location: See Location Plan

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	3/29	---	Dry	---	---
Casing Pulled	3/29	---	Dry	---	1.9'

Plunge: -90
Ground Surface Elevation:
Bearing:
Total Depth: 3.5 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
	Asphalt; delamination at 12.0"							Runway Pavement
1.5	Crushed stone; moist, gray			A			PP = 3.00 tsf	
2.1	FILL, sampled as fat clay; moist, red brown and brown, trace gravel	FILL				S-1, SPT 13+6+4 REC=16", 89%		Fill
3.0	FILL, sampled as elastic silt with sand and gravel; moist, orange brown and brown	FILL				S-2, SPT 3+5+50/5" REC=16", 94%	PP = 3.00 tsf	
3.5								

Bottom of Boring at 3.5 ft.
Boring terminated at auger refusal.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-2**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/28/24 **Finished:** 3/28/24
Location: See Location Plan**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	3/28	---	Dry	---	---
Casing Pulled	3/28	---	Dry	---	1.8'

Plunge: -90 **Bearing:**
Ground Surface Elevation: **Total Depth:** 12.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
1.5	Asphalt; two delaminations at 2.75" and 12.5"							Runway Pavement
2.1	Crushed stone; moist, gray			A		S-1, SPT 17+7+6 REC=18", 100%	MC = 36.3% PP = 4.00 tsf	
	FILL, sampled as fat clay; moist, orange brown and light brown, few sand Change: contains gravel, and root fragments	FILL				S-2, SPT 4+4+6 REC=3", 17%		Fill
4.0	ELASTIC SILT; moist, orange brown and banded light brown, few sand					S-3, SPT 2+4+7 REC=17", 94%	MC = 35.8% PP = 4.00 tsf	Residual
	Change: no sand	MH		B	5	S-4, SPT 3+5+6 REC=18", 100%	MC = 37.0% PP = 3.00 tsf	
	Change: orange brown and banded dark brown					S-5, SPT 3+4+5 REC=18", 100%	MC = 44.3% PP = 3.00 tsf	
	Change: brown and banded light brown				10	S-6, SPT 3+4+6 REC=16", 89%	MC = 43.4% PP = 2.75 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-3**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/29/24 **Finished:** 3/29/24
Location: See Location Plan

Plunge: -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	3/29	---	Dry	---	---
Casing Pulled	3/29	---	Dry	---	7.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
1.5	ASPHALT PAVEMENT; delamination at 5.0 inches			A				Runway Pavement
1.7	Ballast stone gray	GW				S-1, SPT 5+5+8 REC=18", 100%	PP = 4.50 tsf	Residual
	FAT CLAY WITH SAND; moist, red brown, trace gravel, contains mica					S-2, SPT 4+8+11 REC=18", 100%	LL = 69 PL = 28 % Passing #200 = 88.0 PP = 4.50 tsf	
	Change: no gravel					S-3, SPT 5+10+12 REC=18", 100%	PP = 4.50 tsf	
	Change: red brown and light brown					S-4, SPT 5+11+14 REC=18", 100%	PP = 4.50 tsf	
						S-5, SPT 9+12+17 REC=18", 100%	PP = 4.50 tsf	
						S-6, SPT 6+10+14 REC=18", 100%	PP = 4.50 tsf	
12.0		CH		B				

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07_06.GDT 6/5/24



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-4**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/2/24 **Finished:** 4/2/24
Location: See Location Plan

Plunge: -90 **Bearing:**
Ground Surface Elevation: **Total Depth:** 12.0 ft

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	4/2	---	Dry	---	---
Casing Pulled	4/2	---	Dry	---	2.1'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
1.0	Asphalt							Runway Pavement
1.3	Ballast stone gray					S-1, SPT 8+6+7 REC=18", 100%	MC = 36.1% PP = 4.50 tsf	Fill
	FILL, sampled as fat clay; moist, orange brown and light brown, contains mica	FILL		A		S-2, SPT 3+7+12 REC=18", 100%	LL = 86 PL = 33 % Passing #200 = 74.9 MC = 36.7% PP = 4.50 tsf	
4.0	FILL, sampled as fat clay; moist, orange brown and light brown, contains mica	FILL			5	S-3, SPT 3+6+10 REC=18", 100%	MC = 35.2% PP = 4.50 tsf	
7.0	FAT CLAY; moist, orange brown, contains mica	CH		B		S-4, SPT 3+4+6 REC=18", 100%	MC = 50.3% PP = 3.00 tsf	Residual
					10	S-5, SPT 3+4+4 REC=16", 89%	MC = 48.2% PP = 2.75 tsf	
						S-6, SPT 2+3+6 REC=14", 78%	MC = 47.4% PP = 2.50 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06.GDT 6/5/24

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-5**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/2/24 **Finished:** 4/2/24
Location: See Location Plan**Plunge:** -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft

Water Level Observations					
	Date	Time	Depth	Casing	Caved
Completion	4/2	---	Dry	---	---
Casing Pulled	4/2	---	Dry	---	4.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
1.4	Asphalt							Runway Pavement
1.6	Ballast stone gray					S-1, SPT 6+7+8 REC=0", 0%	LL = 55 PL = 22 % Passing #200 = 82.9 PP = 4.00 tsf	Fill
	FILL, sampled as fat clay; moist, brown and gray brown, few sand, contains mica					S-2, SPT 4+6+7 REC=16", 89%		
	Change: brown and light brown	FILL		A		S-3, SPT 4+6+8 REC=18", 100%		
7.0	FAT CLAY; moist, brown, contains mica	CH				S-4, SPT 3+5+7 REC=18", 100%	PP = 3.50 tsf	Residual
9.0	ELASTIC SILT; moist, brown, contains mica	MH		B		S-5, SPT 3+5+7 REC=18", 100%	PP = 3.75 tsf	
						S-6, SPT 2+4+7 REC=18", 100%	PP = 3.25 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06.GDT 6/5/24



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-6**

Contract Number: 23160097.000

Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia

Contractor Foreman: P. Smith

Schnabel Representative: K. Penney

Equipment: CME-45 (Trailer)

Method: 2.25" HSA,
7.0" OD Core Barrel

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/4/24 **Finished:** 4/4/24

Location: See Location Plan

Plunge: -90

Bearing:

Ground Surface Elevation:

Total Depth: 6.7 ft

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	6.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
1.5	Asphalt; delamination at 4.4 inches			A				Runway Pavement
1.8	Ballast stone gray					S-1, SPT 10+6+6 REC=0", 0%	LL = 56 PL = 26 % Passing #200 = 84.7 MC = 52.7% PP = 1.00 tsf MC = 36.5% PP = 0.75 tsf	Residual
	FAT CLAY WITH SAND AND GRAVEL; moist, orange brown and brown	CH				S-2, SPT 3+2+4 REC=18", 100%		
4.0	FAT CLAY; moist, orange brown and brown	CH		B		S-3, SPT 1+3+4 REC=18", 100%		
6.5						S-4, SPT 1+50/1" REC=6", 86%		
6.7	DISINTEGRATED ROCK, sampled as sandy silt with gravel; moist, gray	DR		C				

Bottom of Boring at 6.7 ft.

Boring terminated at auger refusal.

Boring backfilled with cuttings, hole plug, and quick-setting concrete

Bulk sample collected from 2 to 6.7 ft.



Schnabel
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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-7**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/3/24 **Finished:** 4/3/24
Location: See Location Plan

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	4/3	---	Dry	---	---
Casing Pulled	4/3	---	Dry	---	1.3'

Plunge: -90
Ground Surface Elevation:
Bearing:
Total Depth: 6.6 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.9	Asphalt							Runway Pavement
1.7	Crushed stone; moist, gray, contains asphalt fragments			A		S-1, SPT 24+15+7 REC=8", 44%		
3.2	FILL, sampled as fat clay with sand and gravel; moist, orange brown and brown	FILL				S-2, SPT 4+3+2 REC=10", 56%	MC = 19.1%	Fill
4.0	SILT WITH SAND; moist, orange brown	ML		B		S-3, SPT 3+2+3 REC=15", 83%	MC = 28.3%	Residual
6.4	DISINTEGRATED ROCK, sampled as sandy silt with gravel; moist, gray	DR		C		S-4, SPT 50/2" REC=1", 50%		
6.6								

Bottom of Boring at 6.6 ft.
Boring terminated at auger refusal.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-8**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/3/24 **Finished:** 4/3/24
Location: See Location Plan**Plunge:** -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	4/3	---	Dry	---	---
Casing Pulled	4/3	---	Dry	---	2.4'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
1.0	Asphalt							Runway Pavement
2.1	Crushed stone; moist, gray, contains asphalt fragments					S-1, SPT 20+25+14 REC=18", 100%	MC = 8.0%	
4.3	FILL, sampled as lean clay with sand and gravel; moist, brown and light brown	FILL		A		S-2, SPT 8+6+7 REC=18", 100%	LL = 72 PL = 36 % Passing #200 = 84.4 MC = 14.4% PP = 4.50 tsf	Fill
7.0	ELASTIC SILT; moist, red brown and light brown, trace sand, contains mica	MH			5	S-3, SPT 4+7+12 REC=18", 100%	MC = 29.9% PP = 4.50 tsf	Residual
12.0	ELASTIC SILT; moist, mottled red brown and white, trace sand and gravel, contains mica	MH		B	10	S-4, SPT 4+8+12 REC=18", 100%	MC = 30.5% PP = 4.50 tsf	
						S-5, SPT 5+7+11 REC=18", 100%	MC = 27.9% PP = 4.25 tsf	
						S-6, SPT 3+7+9 REC=18", 100%	MC = 29.7% PP = 4.25 tsf	

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-9**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan**Plunge:** -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	1.8'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
1.0	Asphalt							Runway Pavement
2.9	Crushed stone; moist, gray					S-1, SPT 13+17+11 REC=14", 78%	PP = 1.50 tsf	Fill
4.0	FILL, sampled as fat clay with sand; moist, orange brown and red brown	FILL		A		S-2, SPT 5+3+1 REC=14", 78%		
	FILL, sampled as fat clay; moist, red brown and light brown, few sand	FILL			5	S-3, SPT 2+4+5 REC=18", 100%	PP = 4.50 tsf	
7.0	FAT CLAY; moist, brown gray brown	CH				S-4, SPT 2+2+3 REC=18", 100%	PP = 2.50 tsf	Residual
				B		S-5, SPT 3+5+5 REC=15", 83%	PP = 4.00 tsf	
10.5	ELASTIC SILT; moist, orange brown and red brown	MH			10	S-6, SPT 3+2+4 REC=16", 89%	PP = 2.50 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06.GDT 6/5/24

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-10**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan**Plunge:** -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	0.9'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
	Asphalt; delamination at 11.0 inches							Runway Pavement
1.4								
1.8	Crushed stone; moist, gray					S-1, SPT 15+5+3 REC=9", 50%		
	FILL, sampled as elastic silt with sand; moist, gray brown and brown, trace gravel	FILL				S-2, SPT 3+3+3 REC=17", 94%	MC = 30.6% PP = 2.25 tsf	Fill
4.0	FILL, sampled as fat clay; moist, red brown white			A	5	S-3, SPT 1+2+3 REC=17", 94%	MC = 31.1% PP = 1.50 tsf	
		FILL						
	Change: red brown and light brown					S-4, SPT 2+2+4 REC=13", 72%	MC = 34.9% PP = 2.50 tsf	
9.0	FAT CLAY; moist, red brown and brown, trace gravel					S-5, SPT 2+1+3 REC=16", 89%	MC = 33.3% PP = 1.50 tsf	Residual
		CH		B	10	S-6, SPT 1+2+3 REC=9", 50%	MC = 32.4% PP = 2.00 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06.GDT 6/5/24



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-11**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Water Level Observations					
	Date	Time	Depth	Casing	Caved
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	1.6'

Plunge: -90 **Bearing:**
Ground Surface Elevation: **Total Depth:** 12.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.9	Asphalt; delamination at 11.0 inches							Runway Pavement
1.1	Ballast stone gray	GW						
1.5	Crushed stone; moist, gray							
	FILL, sampled as lean clay with sand; moist, red brown and light brown	FILL		A		S-1, SPT 10+3+3 REC=18", 100%	PP = 2.50 tsf	Fill
2.9	Crushed stone; wet, gray					S-2, SPT 2+2+3 REC=18", 100%	LL = 64 PL = 28 % Passing #200 = 84.7 PP = 1.25 tsf	
3.2	FILL, sampled as fat clay with sand; moist, red brown and light brown	FILL						
4.2	FAT CLAY; moist, orange brown and light brown					S-3, SPT 2+2+3 REC=18", 100%	PP = 1.75 tsf	Residual
					5			
						S-4, SPT 2+3+3 REC=18", 100%	PP = 1.75 tsf	
		CH		B				
						S-5, SPT 2+2+2 REC=14", 78%	PP = 2.25 tsf	
					10			
	Change: trace sand					S-6, SPT 2+3+4 REC=14", 78%	PP = 2.50 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-12**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia**Contractor Foreman:** P. Smith**Schnabel Representative:** K. Penney**Equipment:** CME-45 (Trailer)**Method:** 2.25" HSA,
7.0" OD Core Barrel**Hammer Type:** Auto Hammer (140 lb)**Dates Started:** 4/5/24 **Finished:** 4/5/24**Location:** See Location Plan**Plunge:** -90**Bearing:****Ground Surface Elevation:****Total Depth:** 12.0 ft**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	1.6'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
	Asphalt							Runway Pavement
1.2								
1.4	Ballast stone gray	GW						
2.0	Crushed stone; moist, gray					S-1, SPT 17+5+5 REC=12", 67%	MC = 23.4%	
	FILL, sampled as fat clay with sand; moist, red brown, trace gravel, contains asphalt fragments	FILL				S-2, SPT 2+4+5 REC=0", 0%		Fill
4.0	FILL, sampled as fat clay; moist, red brown, trace sand and gravel	FILL		A		S-3, SPT 3+5+5 REC=18", 100%	MC = 21.0% PP = 4.25 tsf	
7.1	FAT CLAY; moist, orange brown and light brown, trace sand and gravel	CH				S-4, SPT 2+2+3 REC=18", 100%	MC = 53.2% PP = 0.75 tsf	Residual
9.0	ELASTIC SILT; moist, orange brown and light brown, trace sand and gravel	MH		B		S-5, SPT 2+2+2 REC=12", 67%	MC = 37.2% PP = 1.75 tsf	
						S-6, SPT 2+4+6 REC=11", 61%	MC = 23.8% PP = 1.50 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06.GDT 6/5/24

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-13**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/8/24 **Finished:** 4/8/24
Location: See Location Plan**Plunge:** -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft

Water Level Observations					
	Date	Time	Depth	Casing	Caved
Completion	4/8	---	Dry	---	---
Casing Pulled	4/8	---	Dry	---	1.9'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.8	Asphalt; delamination at 1.75 inches							Runway Pavement
1.1	Ballast stone-gray							
1.8	Crushed stone; moist, gray					SPT 11+4+5 REC=10", 56%		
	FILL, sampled as fat clay with sand; moist, orange brown and light brown, trace gravel	FILL				SPT 2+2+3 REC=15", 83%	LL = 81 PL = 29 % Passing #200 = 76.4 PP = 2.50 tsf	Fill
4.0	FILL, sampled as fat clay; moist, red brown and light brown, trace sand	FILL		A	5	SPT 3+3+5 REC=15", 83%	PP = 2.00 tsf	
7.0	FILL, sampled as fat clay; moist, red brown and light brown, trace sand and gravel	FILL				SPT 3+3+4 REC=15", 83%	PP = 2.50 tsf	Augers grinding and scraping
	Change: brown and light brown	FILL			10	SPT 2+3+4 REC=11", 61%	PP = 3.50 tsf	
10.5	FAT CLAY; moist, brown and light brown, trace gravel	CH		B		SPT 2+3+4 REC=18", 100%	PP = 3.00 tsf	Residual
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06 GDT 6/5/24



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-14**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/8/24 **Finished:** 4/8/24
Location: See Location Plan

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	4/8	---	Dry	---	---
Casing Pulled	4/8	---	Dry	---	4.5'

Plunge: -90 **Bearing:**
Ground Surface Elevation: **Total Depth:** 12.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.9	Asphalt							Runway Pavement
1.1	Ballast stone-gray							
1.7	Crushed stone; moist, gray					SPT 11+3+3 REC=15", 83%	MC = 34.9% PP = 3.50 tsf	
	FILL, sampled as fat clay with sand; moist, brown and dark brown, trace gravel	FILL				SPT 3+2+2 REC=6", 33%	PP = 3.50 tsf	Fill
4.0	FILL, sampled as fat clay; moist, brown and light brown, trace sand and gravel	FILL			5	SPT 3+4+5 REC=18", 100%	MC = 31.0% PP = 2.50 tsf	Rock in sampler
7.0	FILL, sampled as fat clay; moist, red brown and light brown, trace sand and gravel	FILL		A		SPT 1+3+5 REC=18", 100%	MC = 33.5% PP = 3.50 tsf	
9.0	FILL, sampled as fat clay; moist, brown and red brown, trace sand and gravel	FILL			10	SPT 2+4+6 REC=18", 100%	MC = 31.9% PP = 3.50 tsf	
						SPT 2+3+5 REC=18", 100%	MC = 44.9% PP = 3.25 tsf	
11.7	SILT; moist, light brown and orange brown, trace sand	ML		B				Residual
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06 GDT 6/5/24



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-15**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/9/24 **Finished:** 4/9/24
Location: See Location Plan

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	4/9	---	Dry	---	---
Casing Pulled	4/9	---	Dry	---	1.8'

Plunge: -90 **Bearing:**
Ground Surface Elevation: **Total Depth:** 12.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.8	Asphalt; delamination at 2.4 inches							Runway Pavement
1.2	Ballast stone-gray							
1.7	Crushed stone; moist, gray						PP = 3.50 tsf	Fill
	FILL, sampled as fat clay; moist, red brown, trace sand and gravel	FILL				SPT 6+2+4 REC=13", 72%		
3.0	FILL, sampled as fat clay with sand; moist, red brown and black, trace gravel, contains mica					SPT 3+5+5 REC=18", 100%	PP = 4.00 tsf	
						SPT 3+5+8 REC=18", 100%	PP = 4.25 tsf	
					5			
				A				
	Change: red brown and mottled black	FILL				SPT 4+6+10 REC=18", 100%	PP = 4.25 tsf	
	Change: red brown					SPT 4+6+8 REC=18", 100%	PP = 4.50 tsf	
					10			
						SPT 4+7+10 REC=18", 100%	PP = 4.50 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07_06.GDT 6/5/24



TEST BORING LOG

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-16**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: K. Penney
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/9/24 Finished: 4/9/24
Location: See Location Plan

Water Level Observations					
	Date	Time	Depth	Casing	Caved
Completion	4/9	---	Dry	---	---
Casing Pulled	4/9	---	Dry	---	4.8'

Plunge: -90 Bearing:
Ground Surface Elevation: Total Depth: 12.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
	Asphalt							Runway Pavement
1.1								
1.3	Ballast stone-gray			A				
1.8	Crushed stone; moist, gray					SPT 21+7+4 REC=11", 61%	MC = 14.7%	
	FILL, sampled as fat clay with sand and gravel; moist, red brown, contains mica	FILL					LL = 53 PL = 21 % Passing #200 = 65.3 MC = 24.1% PP = 4.50 tsf	Fill
2.5	FAT CLAY WITH SAND; moist, red brown with mottled black, trace gravel, contains mica					SPT 3+4+8 REC=17", 94%		
						SPT 6+6+8 REC=18", 100%	MC = 24.2% PP = 4.50 tsf	
					5			
						SPT 5+7+9 REC=18", 100%	MC = 24.1% PP = 4.50 tsf	
		CH		B				
						SPT 3+6+8 REC=18", 100%	MC = 23.6% PP = 4.50 tsf	
					10			
						SPT 4+7+9 REC=18", 100%	MC = 24.5% PP = 3.75 tsf	
12.0								Augers grinding and scraping

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-17**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: Dustin Stanley
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/10/24 **Finished:** 4/10/24
Location: See Location Plan**Plunge:** -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	4/10	---	Dry	---	---
Casing Pulled	4/10	2:48 PM	Dry	---	3.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
	Asphalt							Runway Pavement
1.2								
1.4	Ballast stone- gray							
2.0	Crushed stone; moist, gray					S-1 25+10+5 REC=14", 78%	PP = 4.50 tsf	
	FILL, sampled as fat clay; moist, reddish brown, trace sand, and gravel	FILL				S-2 3+5+6 REC=13", 72%	PP = 3.00 tsf	Fill
4.0						S-3 2+4+7 REC=18", 100%	PP = 2.00 tsf	Evidence of lime stabilization observed
	FILL, sampled as sandy fat clay, fine to medium; moist, light brown, trace gravel				5			
				A		S-4 3+5+7 REC=14", 78%	PP = 2.00 tsf	
		FILL				S-5 3+6+10 REC=18", 100%	PP = 2.75 tsf	
					10			
						S-6 3+6+11 REC=15", 83%	PP = 2.50 tsf	
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete



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**TEST
BORING
LOG**

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Boring Number: **B-18**
Contract Number: 23160097.000
Sheet: 1 of 1

Contractor: Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: Dustin Stanley
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/10/24 **Finished:** 4/10/24
Location: See Location Plan

Plunge: -90 **Bearing:**
Ground Surface Elevation: **Total Depth:** 12.0 ft

Water Level Observations

	Date	Time	Depth	Casing	Caved
Completion	4/10	---	Dry	---	---
Casing Pulled	4/10	3:13 AM	Dry	---	4.2'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.7	Asphalt							Runway Pavement
	CEMENT TREATED AGGREGATE							
1.4	Crushed stone; moist, gray							Fill Evidence of lime stabilization observed
1.9	FILL, sampled as fat clay; moist, reddish brown, trace sand, and gravel	FILL				S-1 37+20+35 REC=18", 100%	MC = 30.7% PP = 4.50 tsf	
3.0	FILL, sampled as sandy fat clay, fine to medium; moist, light brown, trace gravel	FILL				S-2 9+14+10 REC=9", 50%	MC = 23.0% PP = 1.75 tsf	
4.0	FILL, sampled as fat clay; moist, reddish brown, trace gravel					S-3 4+4+5 REC=18", 100%	MC = 25.4% PP = 3.75 tsf	
					5			
				A				
						S-4 2+3+2 REC=11", 61%	MC = 22.0% PP = 3.75 tsf	Asphalt fragments observed
						S-5 2+2+3 REC=13", 72%	MC = 23.4% PP = 3.00 tsf	
					10			
						S-6 2+3+50/4" REC=14", 88%		
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete

TEST BORING LOG 23160097 BORING LOGS DRAFT.GPJ SCHNABEL DATA TEMPLATE 2008.07.06 GDT 6/5/24

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** **B-19**
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: Dustin Stanley
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/14/24 **Finished:** 4/14/24
Location: See Location Plan**Plunge:** -90
Ground Surface Elevation:
Bearing:
Total Depth: 12.0 ft**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	4/14	---	Dry	---	---
Casing Pulled	4/14	3:22 AM	Dry	---	1.8'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.7	Asphalt							Runway Pavement
	CEMENT TREATED AGGREGATE							
1.5	Crushed stone; moist, gray							Fill Evidence of lime stabilization observed
2.0	FILL, sampled as fat clay; moist, reddish brown, trace sand, and gravel	FILL				S-1 17+24+39 REC=18", 100%	PP = 4.50 tsf LL = 63 PL = 25 % Passing #200 = 77.8 PP = 3.50 tsf	
						S-2 14+9+7 REC=18", 100%		
4.0	FILL, sampled as fat clay; moist, reddish brown, trace sand, and gravel					S-3 2+2+3 REC=18", 100%	PP = 3.75 tsf	
					5	S-4 2+4+5 REC=18", 100%	PP = 2.50 tsf	
				A		S-5 2+4+5 REC=18", 100%	PP = 3.50 tsf	
						S-6 2+3+3 REC=18", 100%	PP = 2.25 tsf	
12.0					10			

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

**TEST
BORING
LOG****Project:** Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia**Boring Number:** B-20
Contract Number: 23160097.000
Sheet: 1 of 1**Contractor:** Blue Ridge Drilling, Inc.
Blacksburg, Virginia
Contractor Foreman: P. Smith
Schnabel Representative: Dustin Stanley
Equipment: CME-45 (Trailer)
Method: 2.25" HSA,
7.0" OD Core Barrel
Hammer Type: Auto Hammer (140 lb)
Dates Started: 4/14/24 **Finished:** 4/14/24
Location: See Location Plan**Water Level Observations**

	Date	Time	Depth	Casing	Caved
Completion	4/14	---	Dry	---	---
Casing Pulled	4/14	3:37 AM	Dry	---	---

Plunge: -90 **Bearing:**
Ground Surface Elevation: **Total Depth:** 12.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.7	Asphalt							Runway Pavement
1.3	CEMENT TREATED AGGREGATE							
1.8	Crushed stone; moist, gray							Fill Evidence of lime stabilization observed
	FILL, sampled as fat clay; moist, reddish brown, trace sand, and gravel	FILL				S-1 15+20+20 REC=18", 100%	PP = 2.75 tsf MC = 36.8%	
						S-2 7+17+10 REC=9", 50%	LL = 72 PL = 26 % Passing #200 = 80.0 MC = 34.3% PP = 2.75 tsf	
4.0	FILL, sampled as fat clay; moist, reddish brown, trace sand, and gravel					S-3 2+2+4 REC=18", 100%	MC = 29.5% PP = 3.00 tsf	
						S-4 1+2+4 REC=18", 100%	MC = 36.9% PP = 3.25 tsf	
						S-5 2+3+5 REC=18", 100%	MC = 35.8% PP = 2.75 tsf	
						S-6 3+4+8 REC=18", 100%	PP = 4.50 tsf	
11.5	FAT CLAY; moist, dark brown	CH		B				Residual
12.0								

Bottom of Boring at 12.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings, hole plug, and quick-setting concrete
Bulk sample collected from 2 to 12 ft.

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-1	3/29/2024



Additional Comments: Asphalt Pavement – approx. 17.5 inches; Delamination at 12.0 inches
 Base Course – Crushed Stone, approx. 7.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 1 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-2	3/28/2024



Additional Comments:
Asphalt Pavement – approx. 18.0 inches
Delaminations at 2.75 inches and 12.5 inches
Base Course – Crushed Stone, approx. 7.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 2 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-3	3/29/2024



Additional Comments:
Asphalt Pavement – approx. 18.0 inches
Delamination at 5.0 inches
Break due to core extraction methods at 13.5 inches
Base Course – Ballast Stone approx. 2.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 3 of 20
	Photo Taken By: KJP	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	
	Reviewed By: SJW		
	Date Taken: 4-30-2024		

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-4	4/2/2024



Additional Comments:
Asphalt Pavement – approx. 12.0 inches
Base Course – Ballast Stone, approx. 3.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 4 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-5	4/2/2024



Additional Comments:

Asphalt Pavement – approx. 16.25 inches
Break due to core extraction at 9.0 inches
Base Course – Ballast Stone, approx. 3.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 5 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-6	4/4/2024



Additional Comments:

Asphalt Pavement – approx. 18.5 inches
Delamination at 4.4 inches
Base Course – Ballast Stone, approx. 2.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 6 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-7	4/3/2024



Additional Comments:

Asphalt Pavement – approx. 11.0 inches
Break likely due to core extraction at 8.0 inches
Base Course – Crushed Stone, approx. 9.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 7 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-8	4/3/2024



Additional Comments:

Asphalt Pavement – approx. 12.0 inches
 Base Course – Crushed Stone, approx. 13.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 8 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-9	4/4/2024



Additional Comments:

Asphalt Pavement – approx. 12.5 inches
Base Course – Crushed Stone, approx. 22.3 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 9 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-10	4/4/2024



Additional Comments:
Asphalt Pavement – approx. 17.0 inches
Delamination at 11.0 inches
Base Course – Crushed Stone, approx. 4.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 10 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-11	4/5/2024



Additional Comments:

Asphalt Pavement – approx. 10.25 inches
Base Course – Ballast Stone, approx. 3.25 inches
Crushed Stone, approx. 4.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 11 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-12	4/5/2024



Additional Comments:

Asphalt Pavement – approx. 14.75 inches
Base Course – Ballast Stone, approx. 2.5 inches
Crushed Stone, approx. 6.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 12 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-13	4/8/2024



Additional Comments:

Asphalt Pavement – approx. 9.5 inches
Delamination at 1.75 inches
Base Course – Ballast Stone, approx. 4.0 inches
Crushed Stone, approx. 7.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 13 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-14	4/8/2024



Additional Comments:

Asphalt Pavement – approx. 10.25 inches
Base Course – Ballast Stone, approx. 3.25 inches
Crushed Stone, approx. 6.5 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 14 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-15	4/9/2024



Additional Comments:

Asphalt Pavement – approx. 9.25 inches
Delamination at 2.4 inches
Base Course – Ballast Stone, approx. 5.25 inches
Crushed Stone, approx. 6.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 15 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-16	4/9/2024



Additional Comments: Asphalt Pavement – approx. 13.5 inches
Base Course – Ballast Stone, approx. 2.5 inches
Crushed Stone, approx. 5.5

PAVEMENT CORE PHOTOGRAPHIC LOG

 Schnabel ENGINEERING	Photo Taken By: KJP	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	PAGE 16 of 20
	Reviewed By: SJW		
Date Taken: 4-30-2024			

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-17	4/10/2024



Additional Comments:

Asphalt Pavement – approx. 14.0 inches
Base Course – Ballast Stone, approx. 3.0 inches
Crushed Stone, approx. 7.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 17 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-18	4/10/2024



Additional Comments:
Asphalt Pavement – approx. 8.5 inches
Cement Treated Aggregate – approx. 7.5 inches
Base Course – Crushed Stone, approx. 6.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 18 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-19	4/14/2024



Additional Comments:
Asphalt Pavement – approx. 8.25 inches
Delamination at 2.75 inches
Cement Treated Aggregate – approx. 9.5 inches
Base Course – Crushed Stone, approx. 6.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 19 of 20
	Photo Taken By: KJP	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	
	Reviewed By: SJW		
	Date Taken: 4-30-2024		

	SCHNABEL #:	BORING #:	DRILL DATE:
	23160097.000	B-20	4/14/2024



Additional Comments:

Asphalt Pavement – approx. 8.5 inches
Cement Treated Aggregate – approx. 7.0 inches
Base Course – Crushed Stone, approx. 6.0 inches

 Schnabel ENGINEERING	PAVEMENT CORE PHOTOGRAPHIC LOG		PAGE 20 of 20
	Photo Taken By: KJP Reviewed By: SJW Date Taken: 4-30-2024	Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia	

APPENDIX B

SOIL LABORATORY TEST DATA

Summary of Soil Laboratory Tests (2)
Atterberg Limits
Gradation Test Curves (10)
Moisture Density Relationship Curves (10)
California Bearing Ratio Test Curves (10)

Summary Of Laboratory Tests

Appendix
Sheet 1 of 2
Project Number: 23160097.000

Boring No.	Sample Depth ft	Sample Type	Description of Soil Specimen	Liquid Limit	Plasticity Index	% Passing No. 200 Sieve	Percent Sand	Percent Gravel	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Corrected Max. Dry Density (pcf)	Corrected Optimum Moisture Content (%)	Proctor Test Method	CBR Value	CBR Percent Swell	CBR Surcharge Pressure (psf)	Testing Laboratory
B-3	2.0 - 12.0	Bulk	FAT CLAY (CH), few sand, reddish brown	69	41	88.0	12.0	0.0	107.0	20.4	--	--	1557A	7.8	3.4	50	BLAC
B-4	2.0 - 12.0	Bulk	FAT CLAY WITH SAND (CH), few gravel, reddish brown	86	53	74.9	17.5	7.6	106.3	20.4	--	--	1557B	3.7	8.3	50	BLAC
B-5	2.0 - 12.0	Bulk	FAT CLAY WITH SAND (CH), trace gravel, brown	55	33	82.9	16.8	0.3	117.2	15.4	--	--	1557B	8.3	3.8	50	BLAC
B-6	2.0 - 6.7	Bulk	FAT CLAY (CH), few sand, trace gravel, orangish brown	56	30	84.7	11.9	3.4	111.7	15.0	--	--	1557B	6.8	3.7	50	BLAC
B-8	2.0 - 12.0	Bulk	ELASTIC SILT (MH), few sand, trace gravel, reddish brown	72	36	84.4	14.1	1.5	119.3	13.7	--	--	1557B	9.6	3.0	50	BLAC
B-11	2.0 - 12.0	Bulk	FAT CLAY WITH SAND (CH), trace gravel, reddish brown	64	36	84.7	13.2	2.1	108.2	19.2	--	--	1557B	12.9	1.4	50	BLAC
B-13	2.0 - 12.0	Bulk	FAT CLAY WITH SAND (CH), few gravel, reddish brown	81	52	76.4	15.3	8.3	110.8	18.0	113.5	16.9	1557B	5.4	5.0	50	BLAC

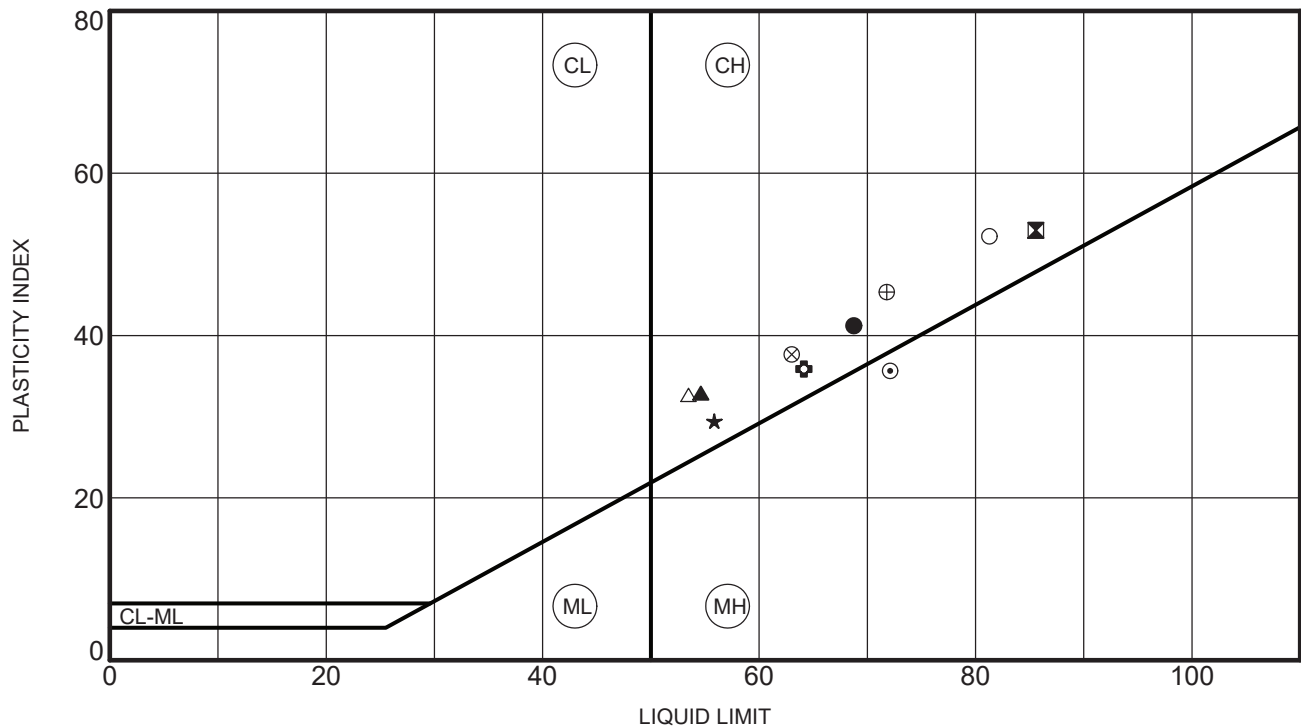
Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487 (as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed; ND=Not Detected



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Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Summary Of Laboratory Tests																			Appendix Sheet 2 of 2 Project Number: 23160097.000									
Boring No.	Sample Depth ft	Sample Type	Description of Soil Specimen	Liquid Limit	Plasticity Index	% Passing No. 200 Sieve	Percent Sand	Percent Gravel	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Corrected Max. Dry Density (pcf)	Corrected Optimum Moisture Content (%)	Proctor Test Method	CBR Value	CBR Percent Swell	CBR Surcharge Pressure (psf)	Testing Laboratory											
	Elevation ft																											
B-16	2.0 - 12.0	Bulk	SANDY FAT CLAY (CH), few gravel, reddish brown	53	32	65.3	24.7	10.0	120.2	14.6	--	--	1557B	27.2	0.5	50	BLAC											
B-19	2.0 - 12.0	Bulk	FAT CLAY WITH SAND (CH), few gravel, brown	63	38	77.8	16.9	5.3	108.7	19.1	--	--	1557B	40.8	1.2	50	BLAC											
B-20	2.0 - 12.0	Bulk	FAT CLAY WITH SAND (CH), trace gravel, orangish brown	72	46	80.0	18.3	1.7	111.4	17.9	--	--	1557B	16.7	2.0	50	BLAC											
Notes:																			 Schnabel ENGINEERING Project: Roanoke-Blacksburg Regional Airport Runway 6-24 Rehabilitation Roanoke, Virginia									
																								1. Soil tests in general accordance with ASTM standards. 2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification. 3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed; ND=Not Detected				



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen	LL	PL	PI	Fines	Testing Lab	Description	
●	B-3	2.0 ft	69	28	41	88	BLAC	FAT CLAY (CH), few sand, reddish brown
⊗	B-4	2.0 ft	86	33	53	75	BLAC	FAT CLAY WITH SAND (CH), few gravel, reddish brown
▲	B-5	2.0 ft	55	22	33	83	BLAC	FAT CLAY WITH SAND (CH), trace gravel, brown
★	B-6	2.0 ft	56	26	30	85	BLAC	FAT CLAY (CH), few sand, trace gravel, orangish brown
⊙	B-8	2.0 ft	72	36	36	84	BLAC	ELASTIC SILT (MH), few sand, trace gravel, reddish brown
⊕	B-11	2.0 ft	64	28	36	85	BLAC	FAT CLAY WITH SAND (CH), trace gravel, reddish brown
○	B-13	2.0 ft	81	29	52	76	BLAC	FAT CLAY WITH SAND (CH), few gravel, reddish brown
△	B-16	2.0 ft	53	21	32	65	BLAC	SANDY FAT CLAY (CH), few gravel, reddish brown
⊗	B-19	2.0 ft	63	25	38	78	BLAC	FAT CLAY WITH SAND (CH), few gravel, brown
⊕	B-20	2.0 ft	72	26	46	80	BLAC	FAT CLAY WITH SAND (CH), trace gravel, orangish brown



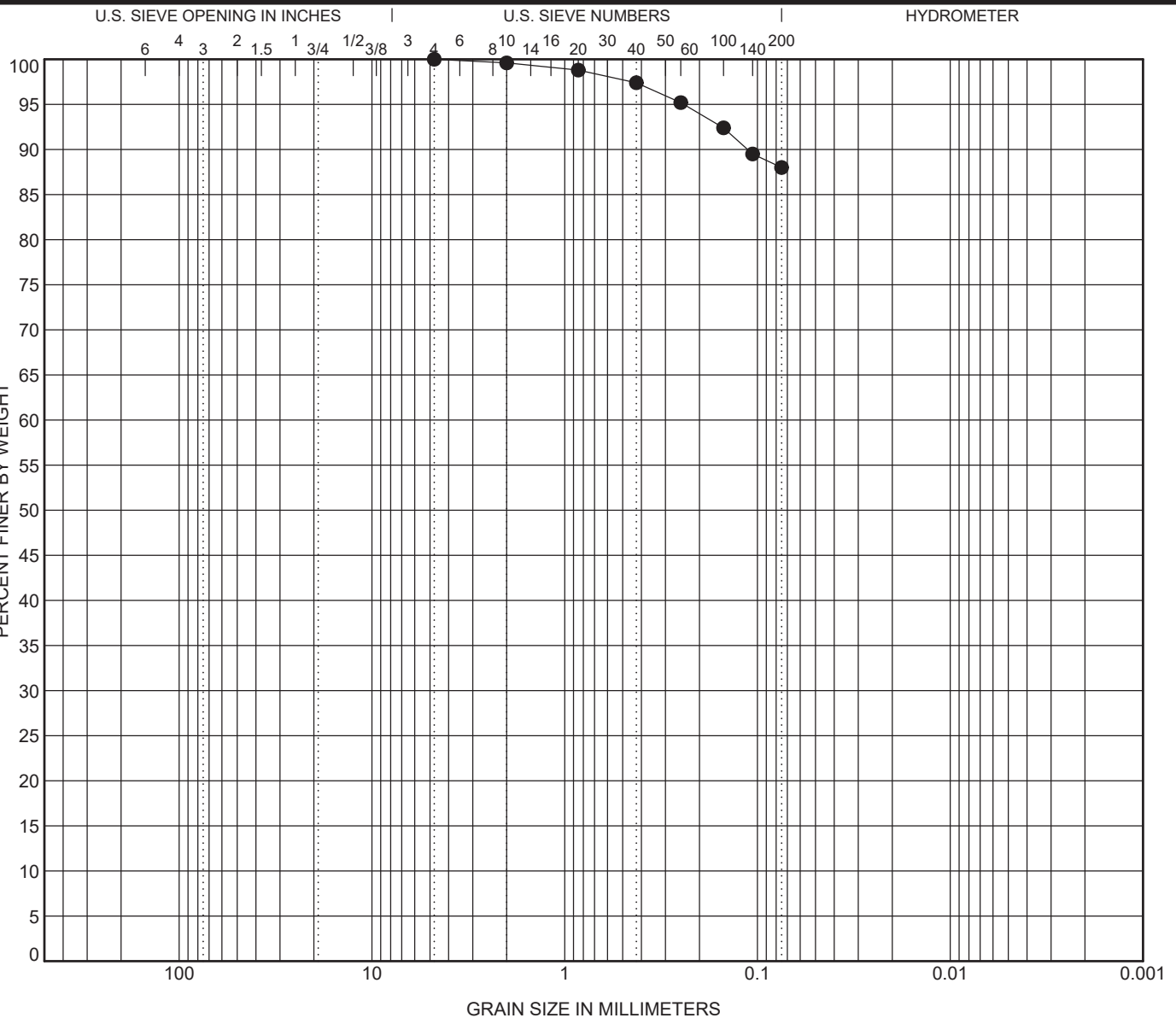
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ATTERBERG LIMITS

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000

PERCENT FINER BY WEIGHT



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-3	2.0 ft	FAT CLAY (CH), few sand, reddish brown					69	28	41	
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	4.75				0.0	12.0	88.0			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4
% Finer	88.0	89.5	92.4	95.2	97.4	98.8	99.6	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/9/24	ACL	MJF

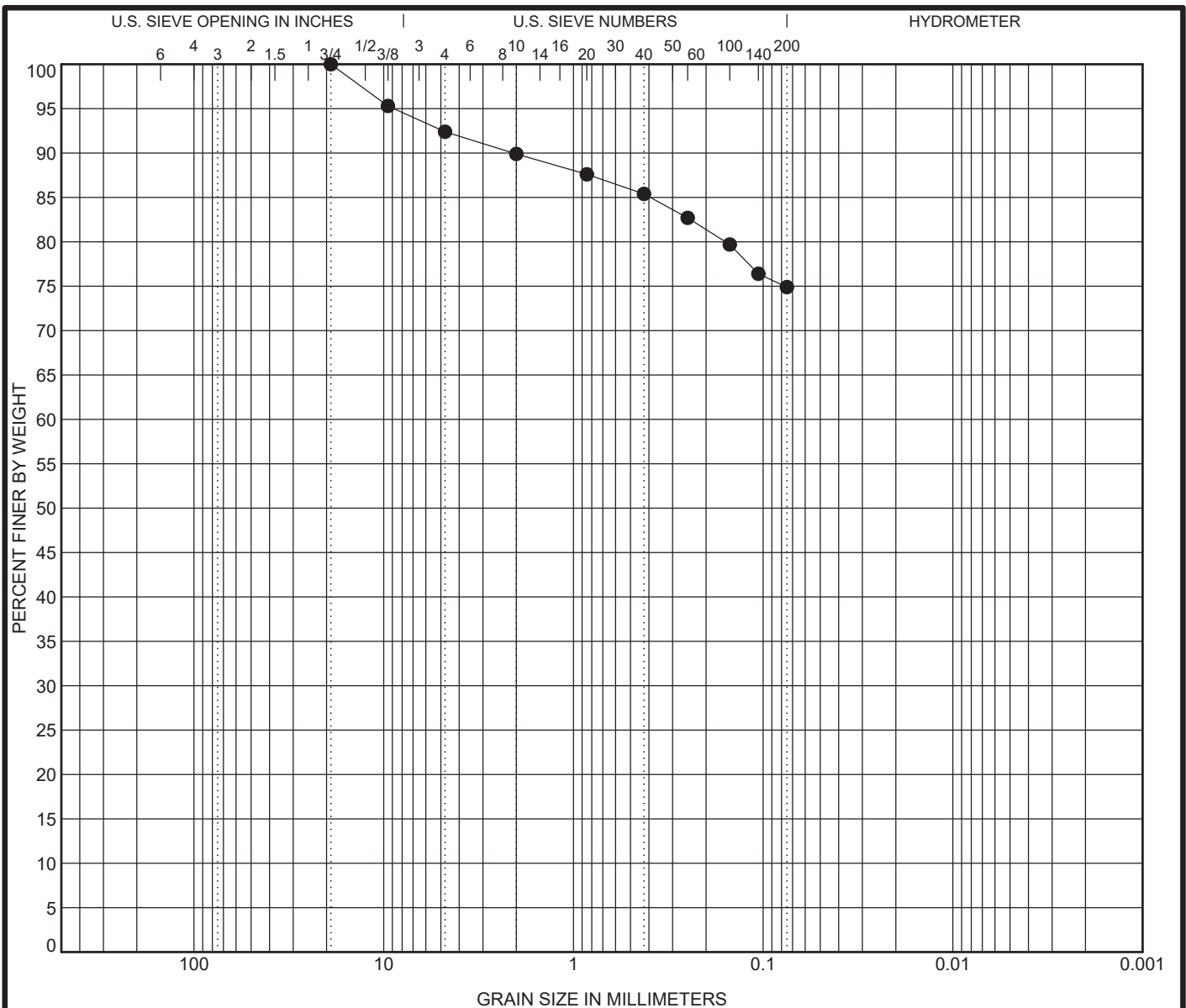


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GRADATION CURVE

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-4 2.0 ft	FAT CLAY WITH SAND (CH), few gravel, reddish brown					86	33	53		
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	19				7.6	17.5	74.9			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.
% Finer	74.9	76.4	79.7	82.7	85.4	87.6	89.9	92.4	95.3	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/9/45	ACL	MJF



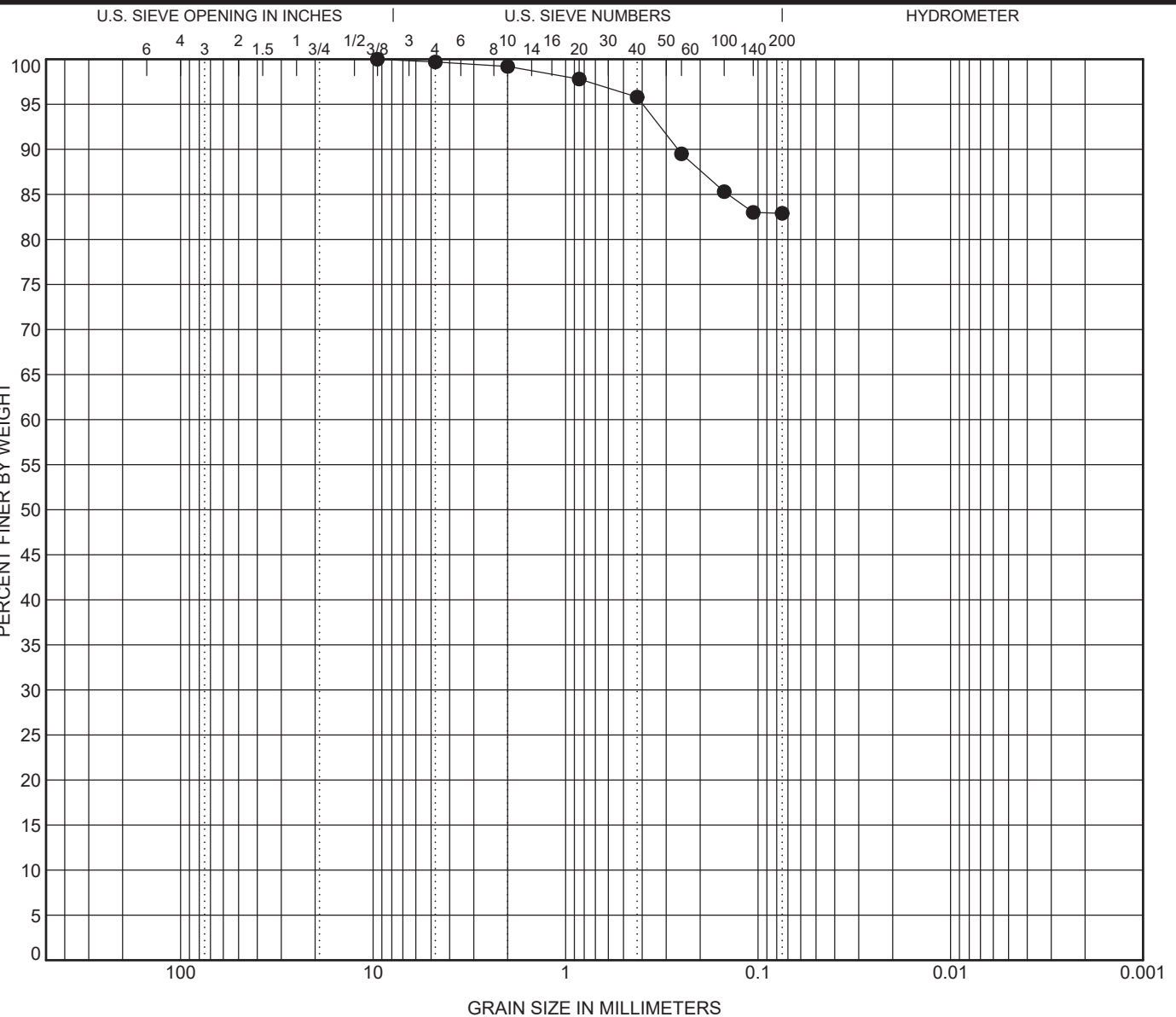
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GRADATION CURVE

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

PERCENT FINER BY WEIGHT



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-5	2.0 ft	FAT CLAY WITH SAND (CH), trace gravel, brown					55	22	33	
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	9.5				0.3	16.8	82.9			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.
% Finer	82.9	83.0	85.3	89.5	95.8	97.8	99.2	99.7	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/9/24	ACL	MJF



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GRADATION CURVE

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



●

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.
% Finer	84.7	86.0	87.6	88.8	90.1	91.7	94.1	96.6	99.0	100.0

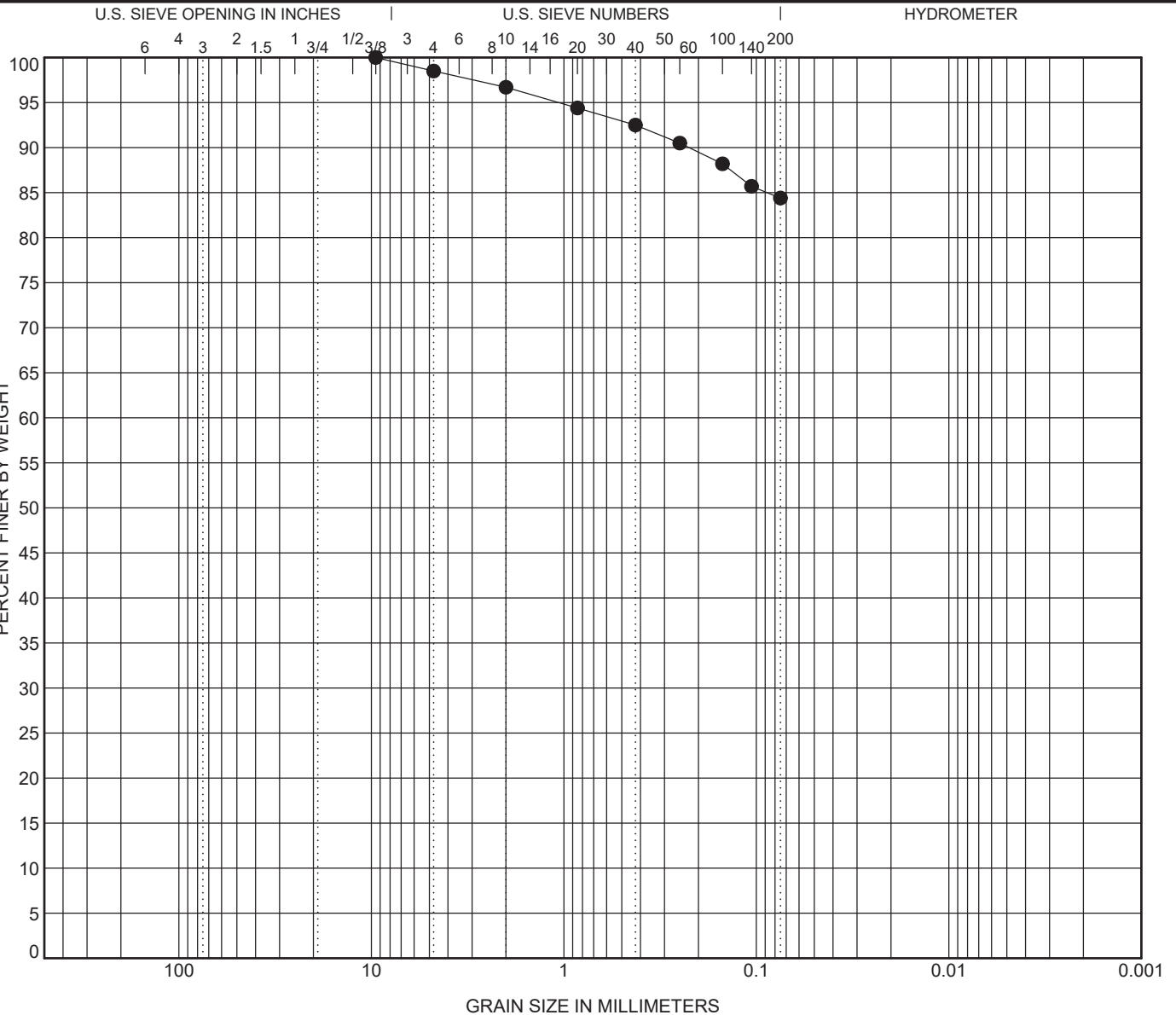
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Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

PERCENT FINER BY WEIGHT



GRAIN SIZE IN MILLIMETERS

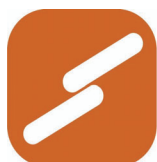
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-8 2.0 ft	ELASTIC SILT (MH), few sand, trace gravel, reddish brown					72	36	36		
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	9.5				1.5	14.1	84.4			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.
% Finer	84.4	85.7	88.2	90.5	92.5	94.4	96.7	98.5	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/9/24	ACL	MJF



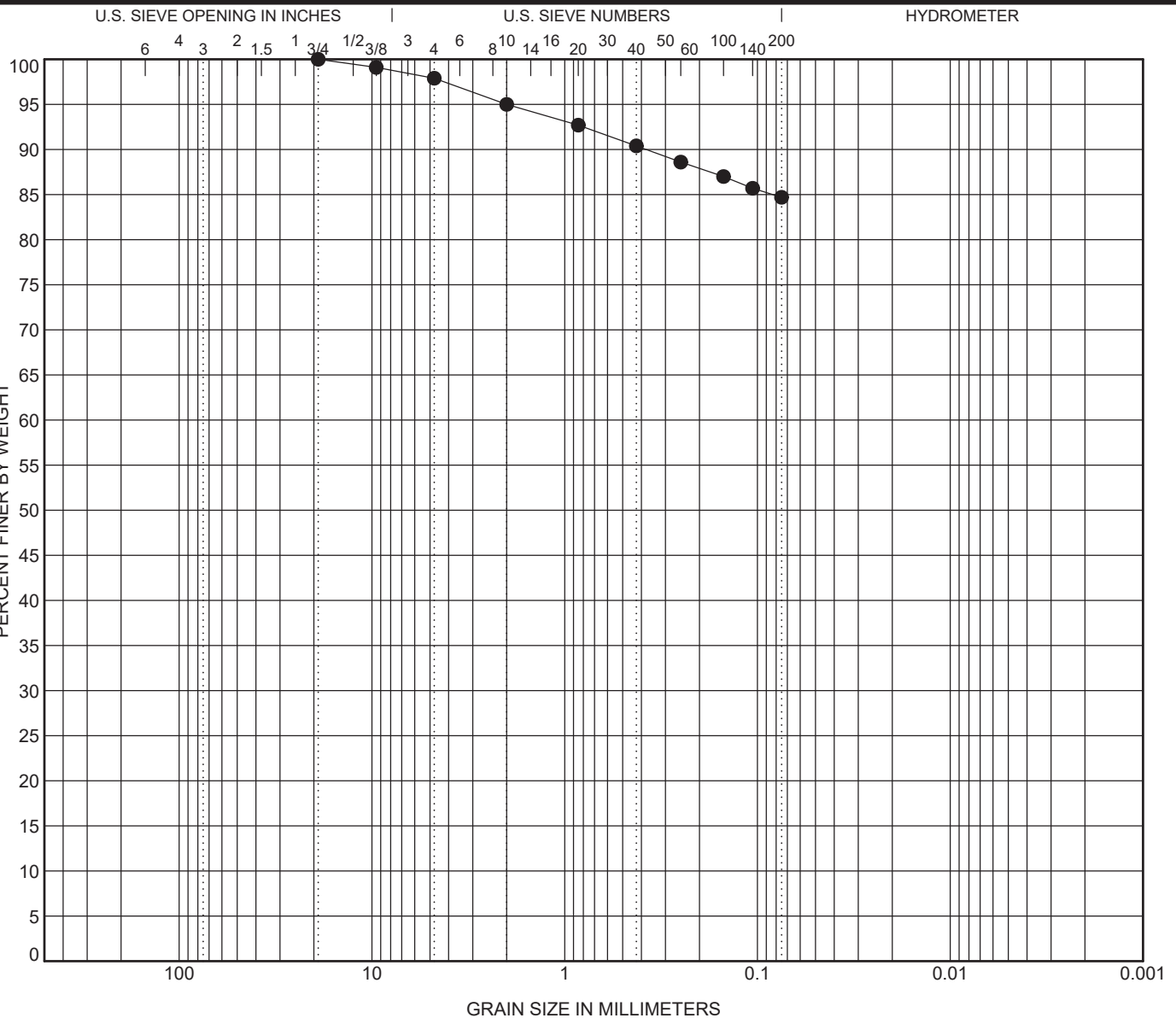
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GRADATION CURVE

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

PERCENT FINER BY WEIGHT



GRAIN SIZE IN MILLIMETERS

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-11	2.0 ft	FAT CLAY WITH SAND (CH), trace gravel, reddish brown					64	28	36	
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	19				2.1	13.2	84.7			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.
% Finer	84.7	85.7	87.0	88.6	90.4	92.7	95.0	97.9	99.1	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/9/24	ACL	MJF

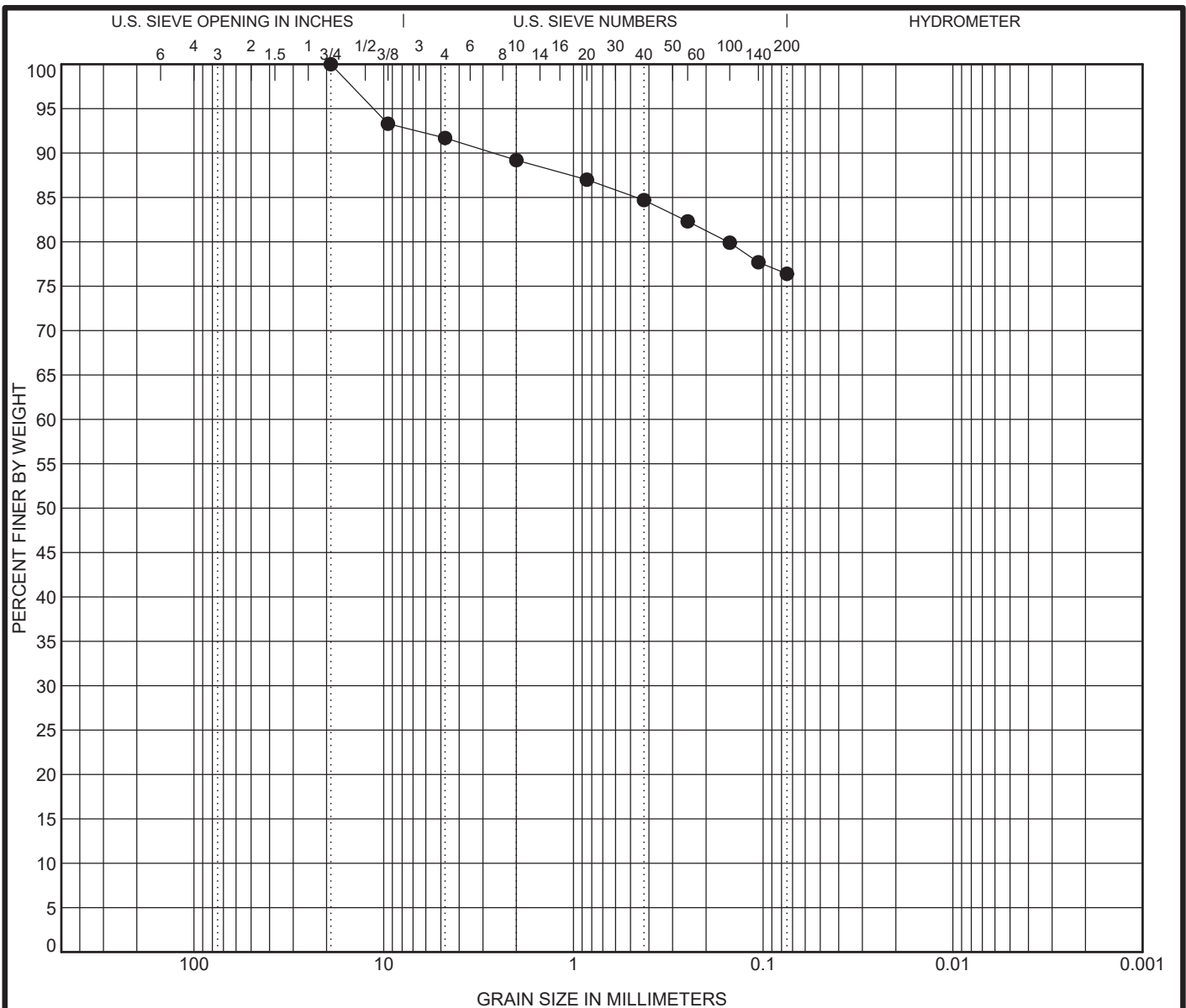


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Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



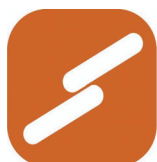
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-13 2.0 ft	FAT CLAY WITH SAND (CH), few gravel, reddish brown					81	29	52		
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	19				8.3	15.3	76.4			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.
% Finer	76.4	77.7	79.9	82.3	84.7	87.0	89.2	91.7	93.3	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/17/24	ACL	MJF

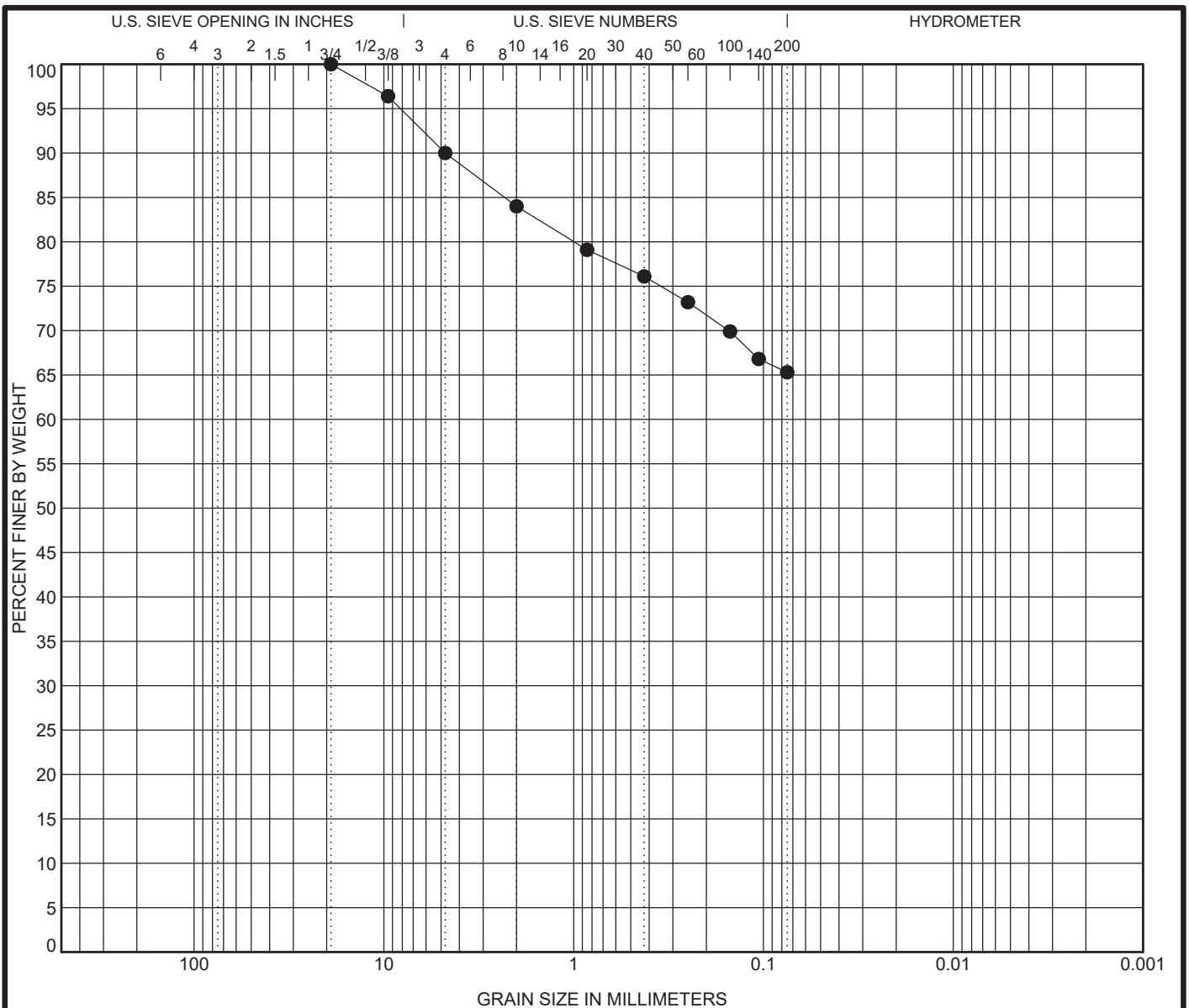


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GRADATION CURVE

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



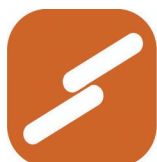
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-16	2.0 ft	SANDY FAT CLAY (CH), few gravel, reddish brown					53	21	32	
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	19				10.0	24.7	65.3			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.
% Finer	65.3	66.8	69.9	73.2	76.1	79.1	84.0	90.0	96.4	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/17/24	ACL	MJF

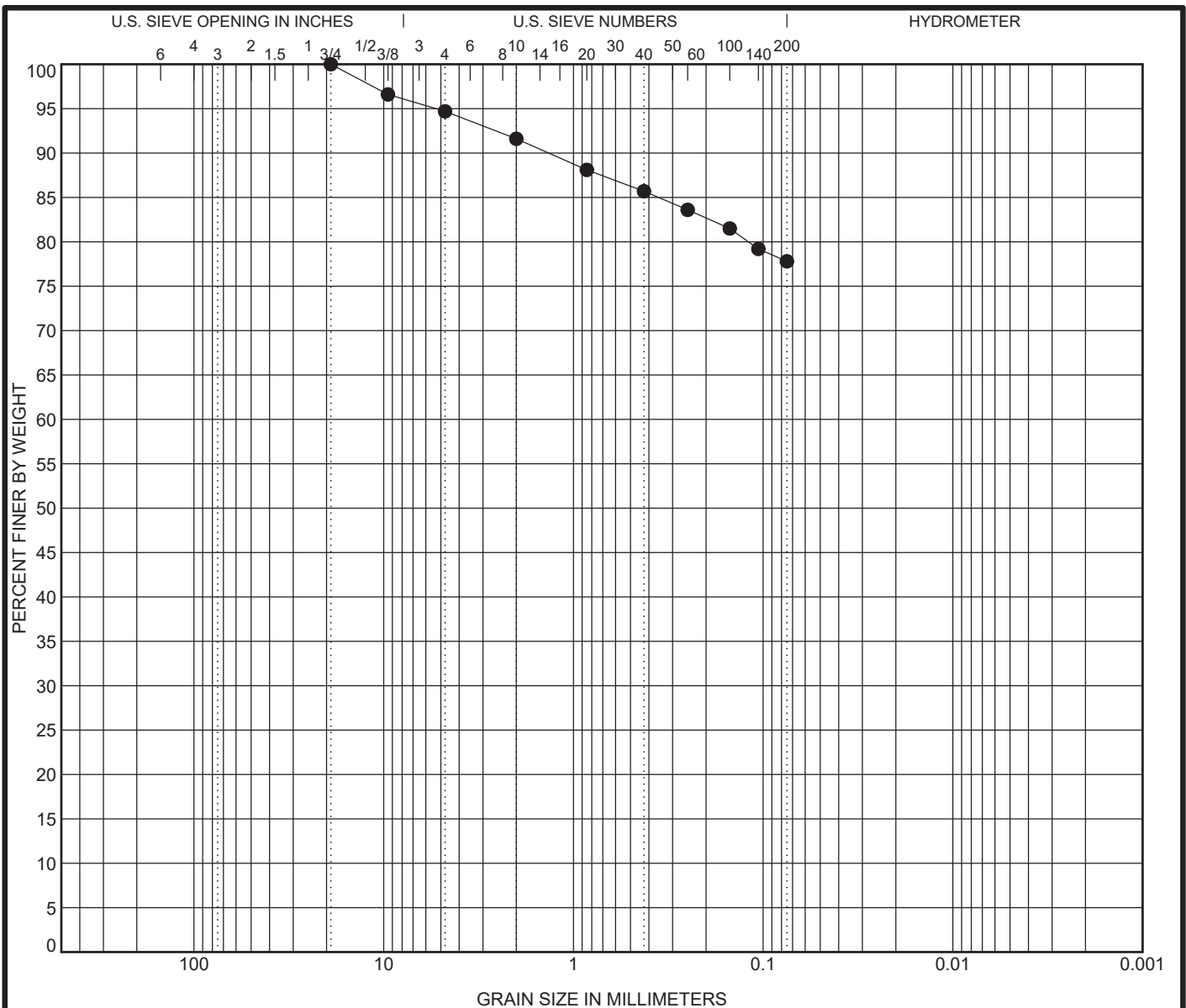


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Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-19 2.0 ft	FAT CLAY WITH SAND (CH), few gravel, brown					63	25	38		
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	19				5.3	16.9	77.8			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.
% Finer	77.8	79.2	81.5	83.6	85.7	88.1	91.6	94.7	96.6	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/17/24	ACL	MJF



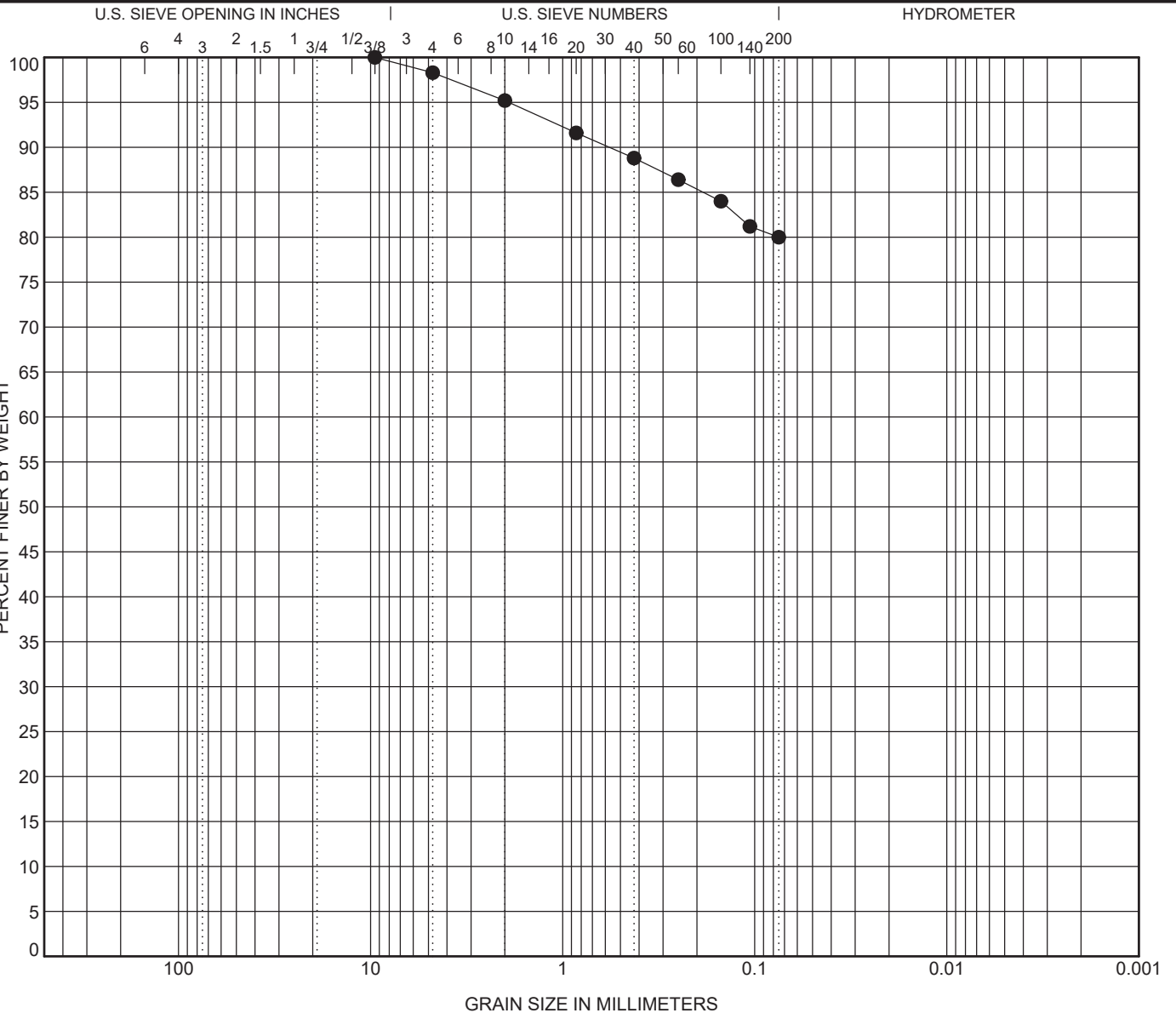
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ENGINEERING

GRADATION CURVE

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

PERCENT FINER BY WEIGHT



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-20	2.0 ft	FAT CLAY WITH SAND (CH), trace gravel, orangish brown					72	26	46	
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D422	9.5				1.7	18.3	80.0			

Percent Finer

Sieve Size	No. 200	No. 140	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.
% Finer	80.0	81.2	84.0	86.4	88.8	91.6	95.2	98.3	100.0

Tested By	Tested Date	Reviewed By	Calc By
MJF	4/17/24	ACL	MJF

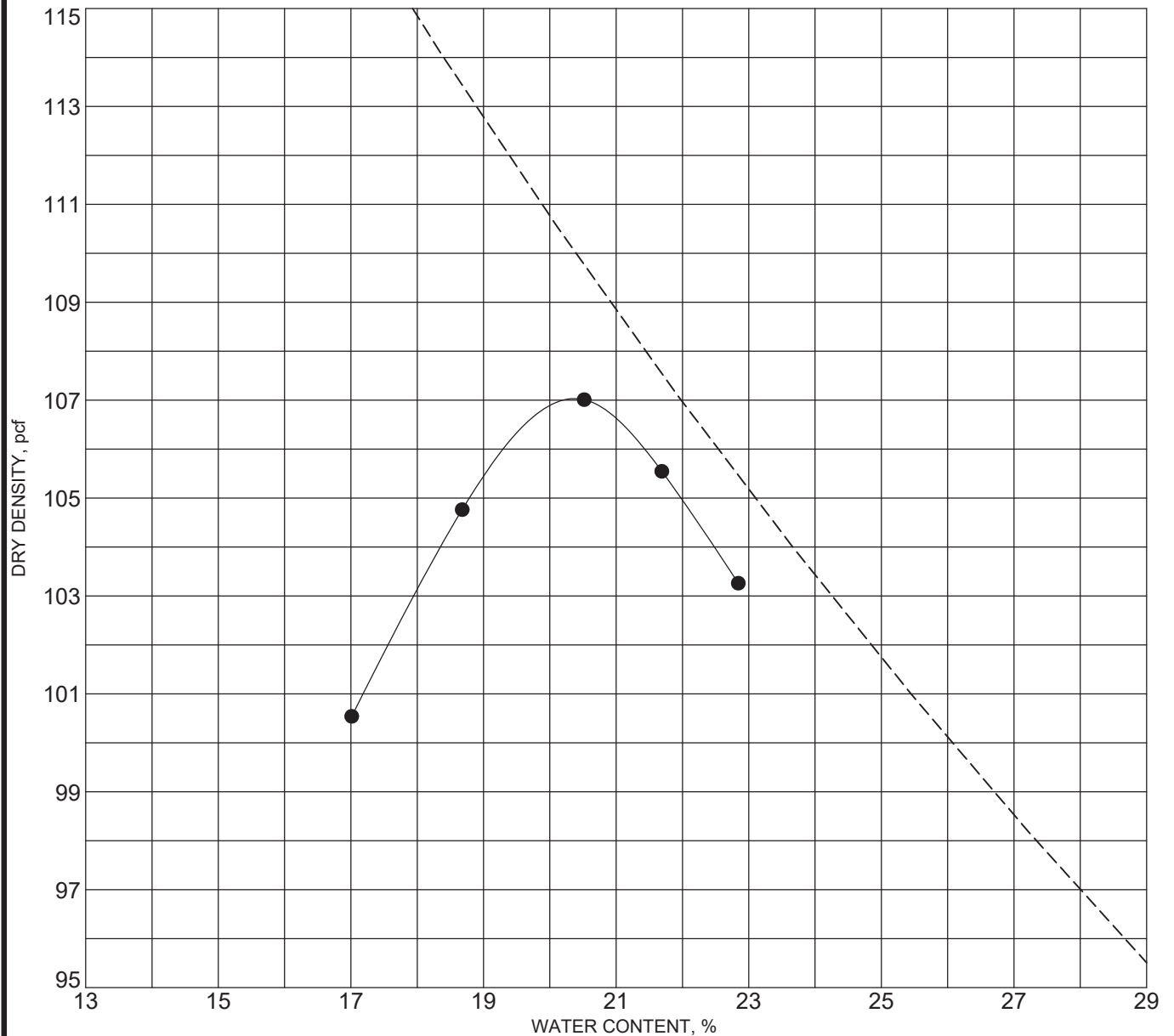


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GRADATION CURVE

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY (CH), few sand, reddish brown

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 107.0

Opt. Moisture (%): 20.4

Sample Source: B-3, 2.0 ft

Test Methods: ASTM D1557 Method A

Liquid Limit (LL): 69

Plasticity Index (PI): 41

% Retained #4 Sieve: 0.0

% Passing # 200 Sieve: 88.0

Comments:

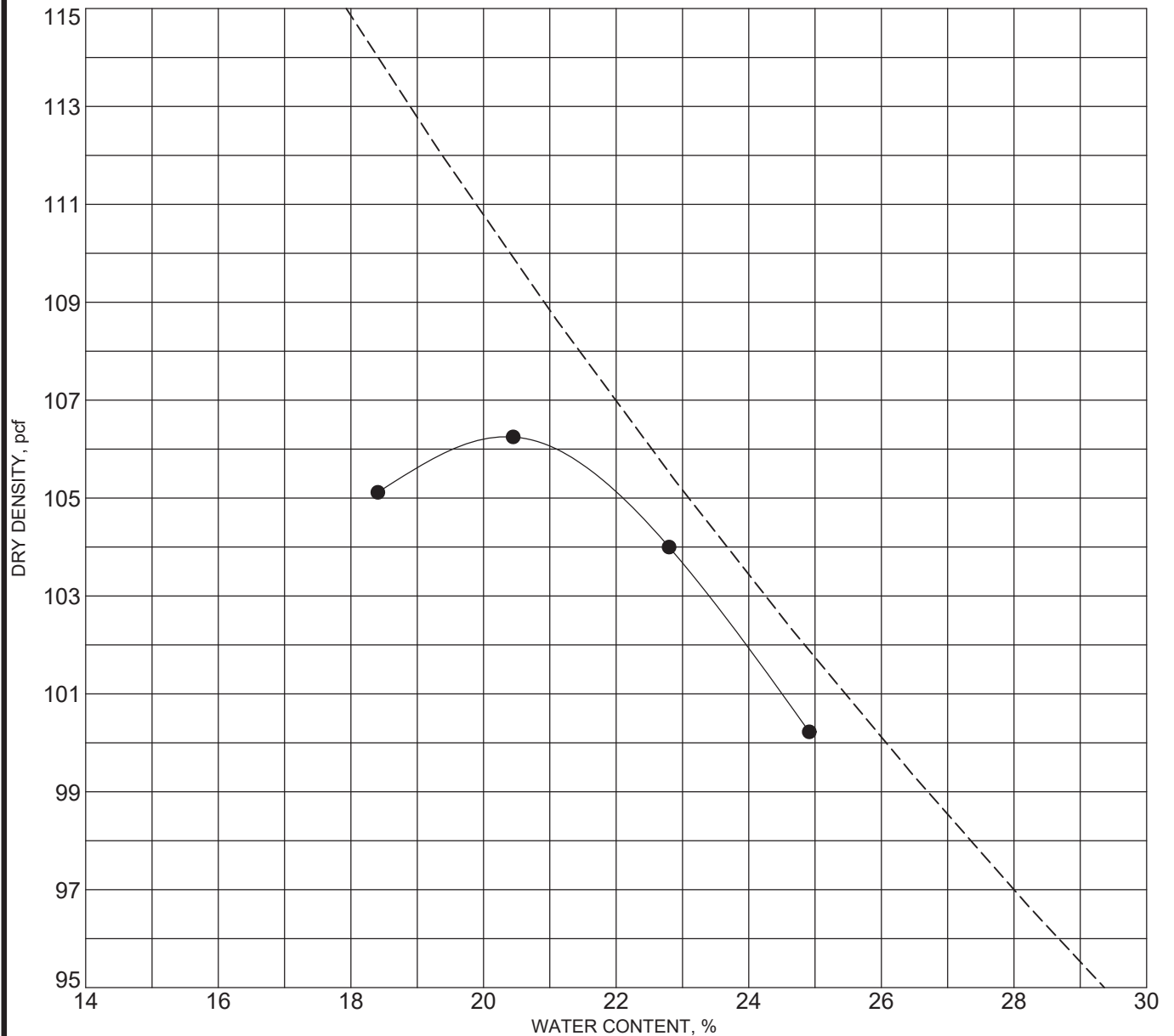


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY WITH SAND (CH), few gravel, reddish brown

Sample Source: B-4, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 106.3

Opt. Moisture (%): 20.4

Liquid Limit (LL): 86

Plasticity Index (PI): 53

% Retained #4 Sieve: 7.6

% Passing # 200 Sieve: 74.9

Comments:

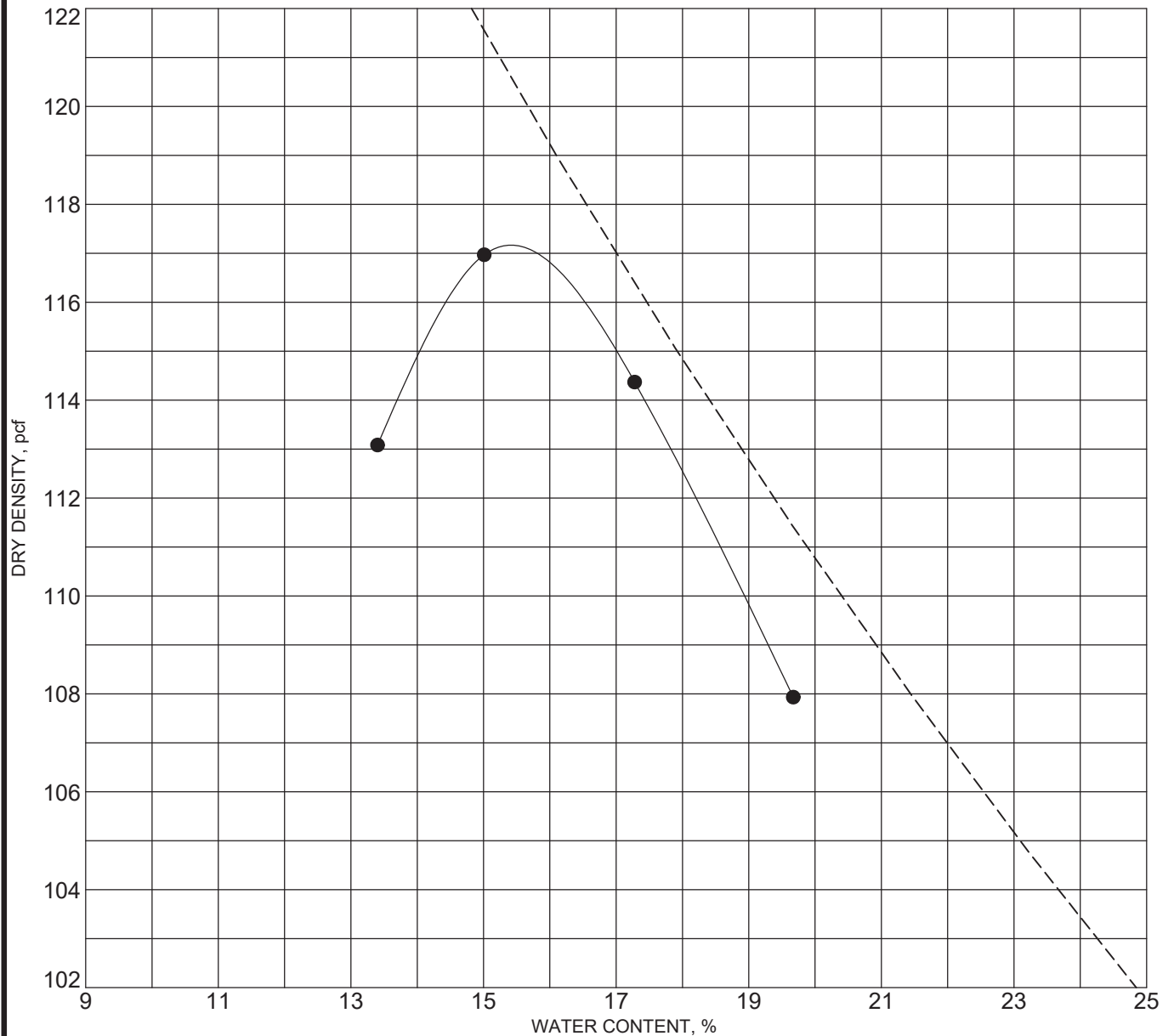


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY WITH SAND (CH), trace gravel, brown

Sample Source: B-5, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 117.2

Opt. Moisture (%): 15.4

Liquid Limit (LL): 55

Plasticity Index (PI): 33

% Retained #4 Sieve: 0.3

% Passing # 200 Sieve: 82.9

Comments:

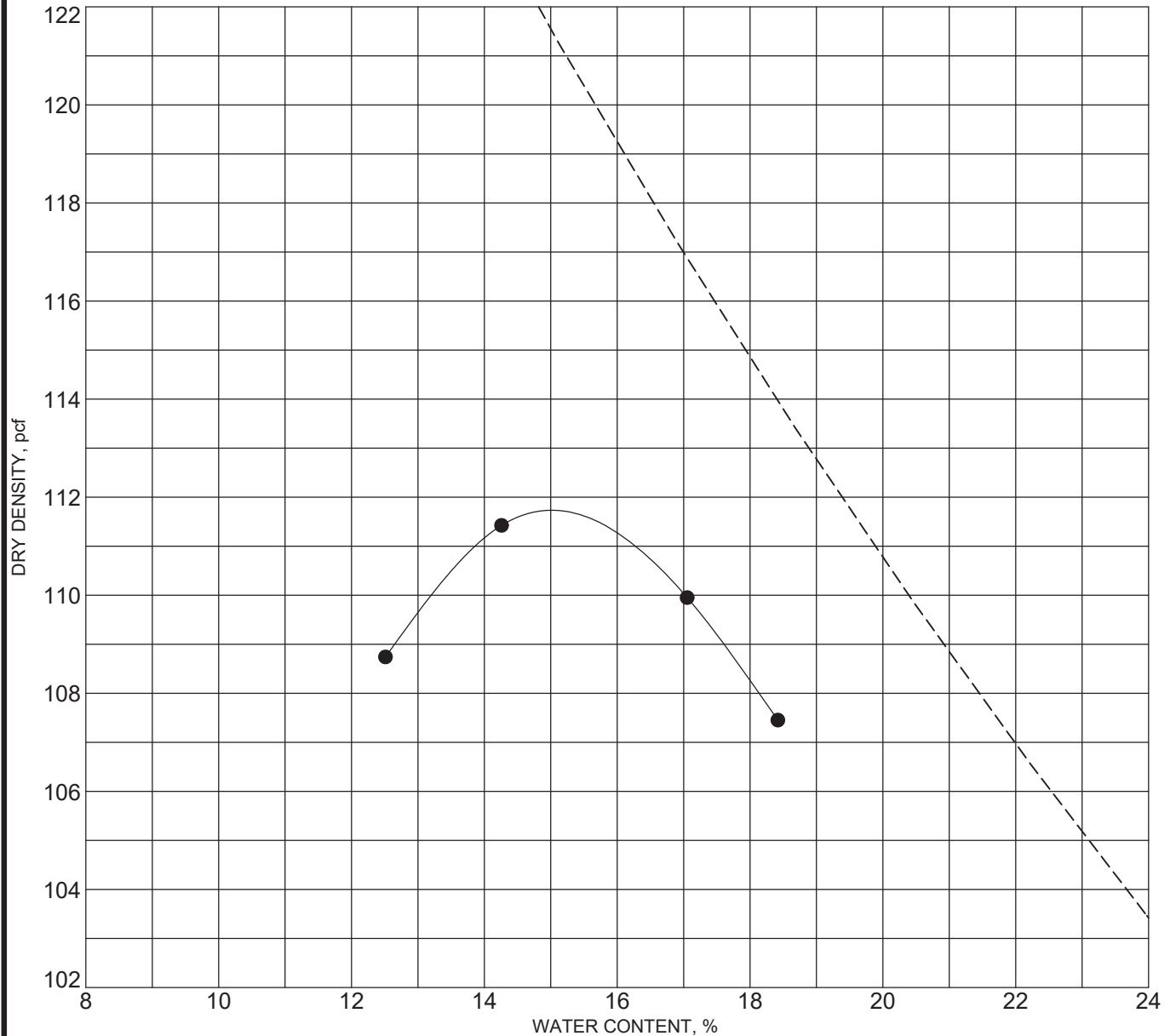


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY (CH), few sand, trace gravel, orangish brown

Sample Source: B-6, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 111.7

Opt. Moisture (%): 15.0

Liquid Limit (LL): 56

Plasticity Index (PI): 30

% Retained #4 Sieve: 3.4

% Passing # 200 Sieve: 84.7

Comments:

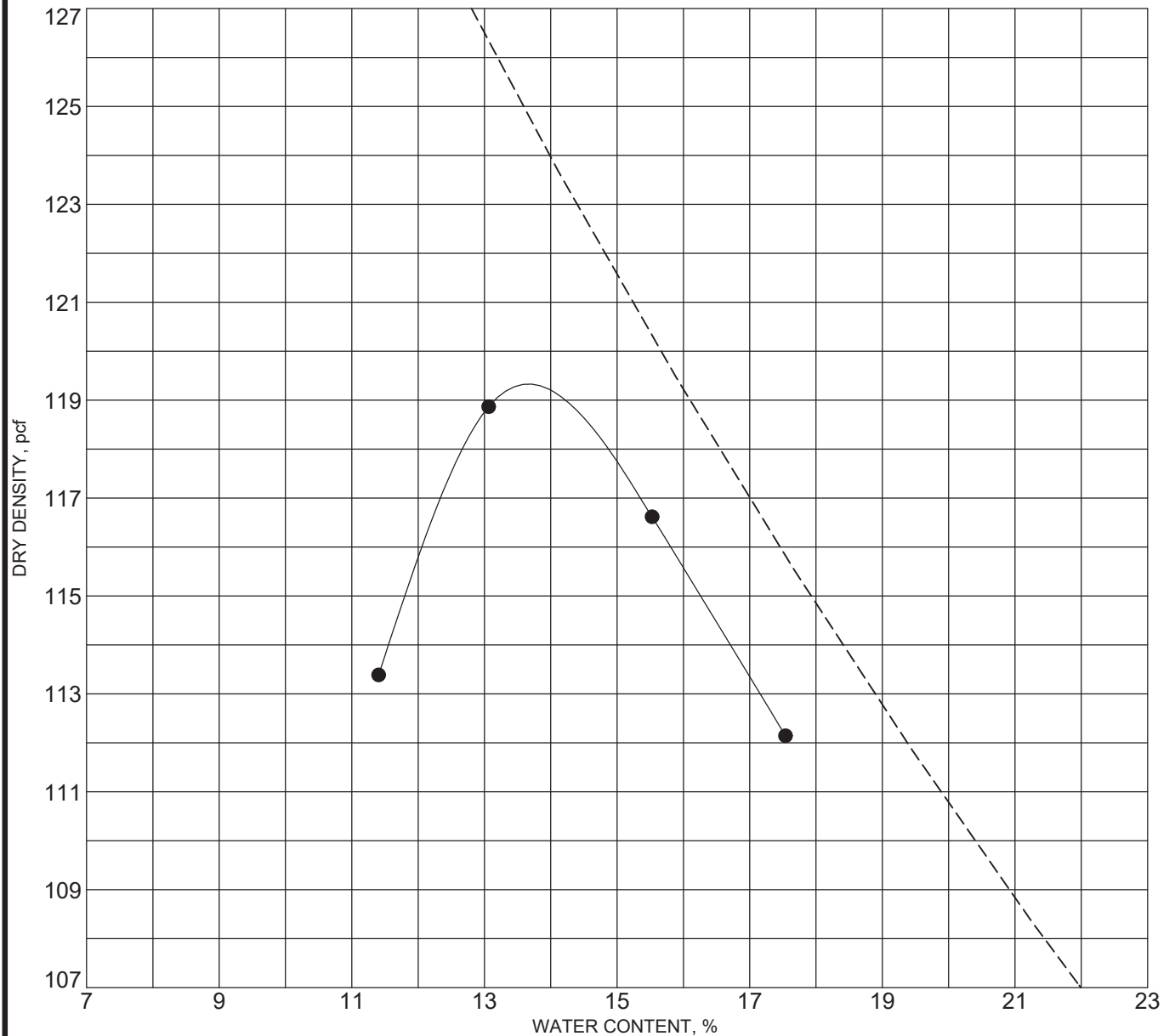


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: ELASTIC SILT (MH), few sand, trace gravel, reddish brown

Sample Source: B-8, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 119.3

Opt. Moisture (%): 13.7

Liquid Limit (LL): 72

Plasticity Index (PI): 36

% Retained #4 Sieve: 1.5

% Passing # 200 Sieve: 84.4

Comments:

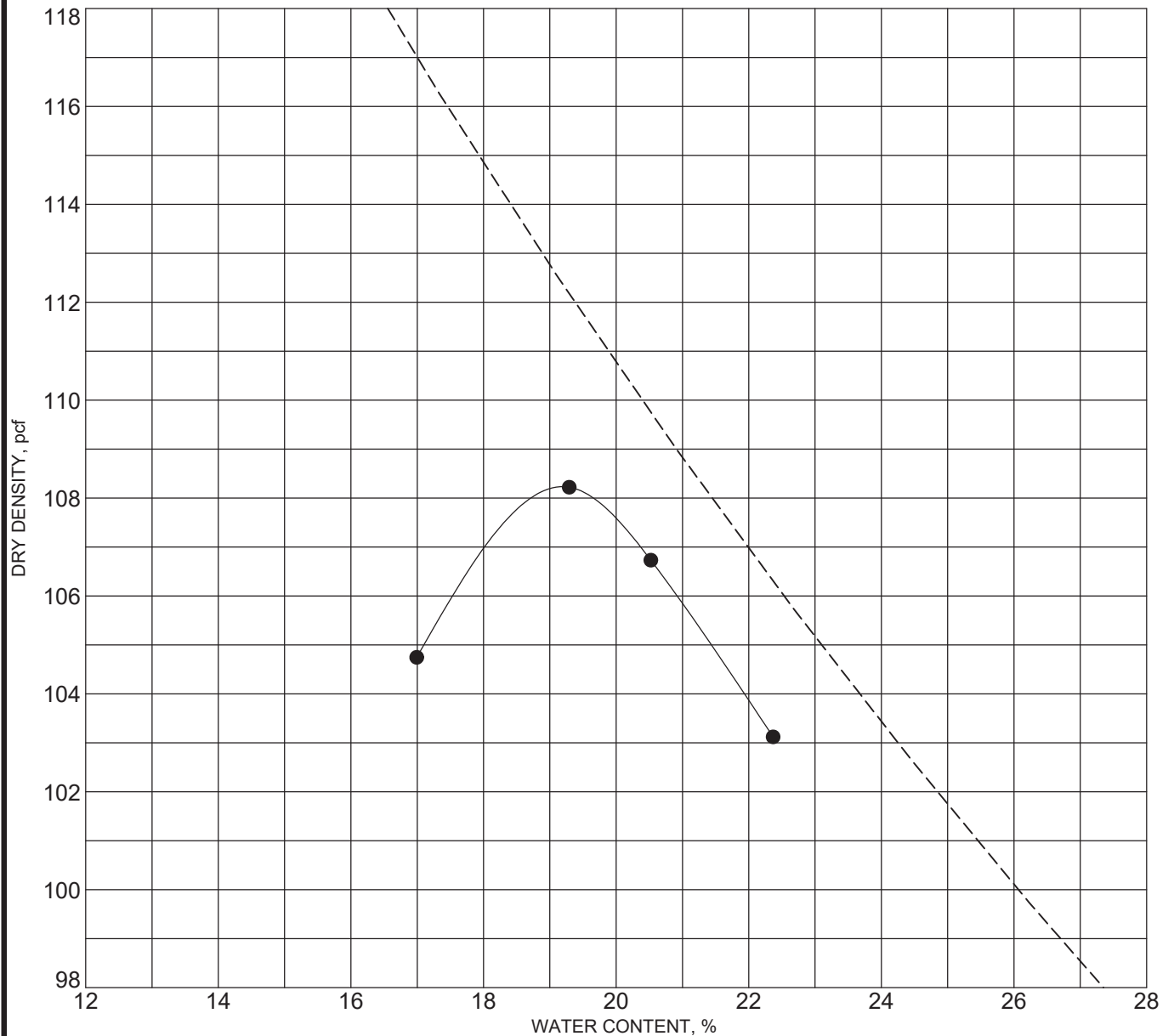


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY WITH SAND (CH), trace gravel, reddish brown

Sample Source: B-11, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 108.2

Opt. Moisture (%): 19.2

Liquid Limit (LL): 64

Plasticity Index (PI): 36

% Retained #4 Sieve: 2.1

% Passing # 200 Sieve: 84.7

Comments:

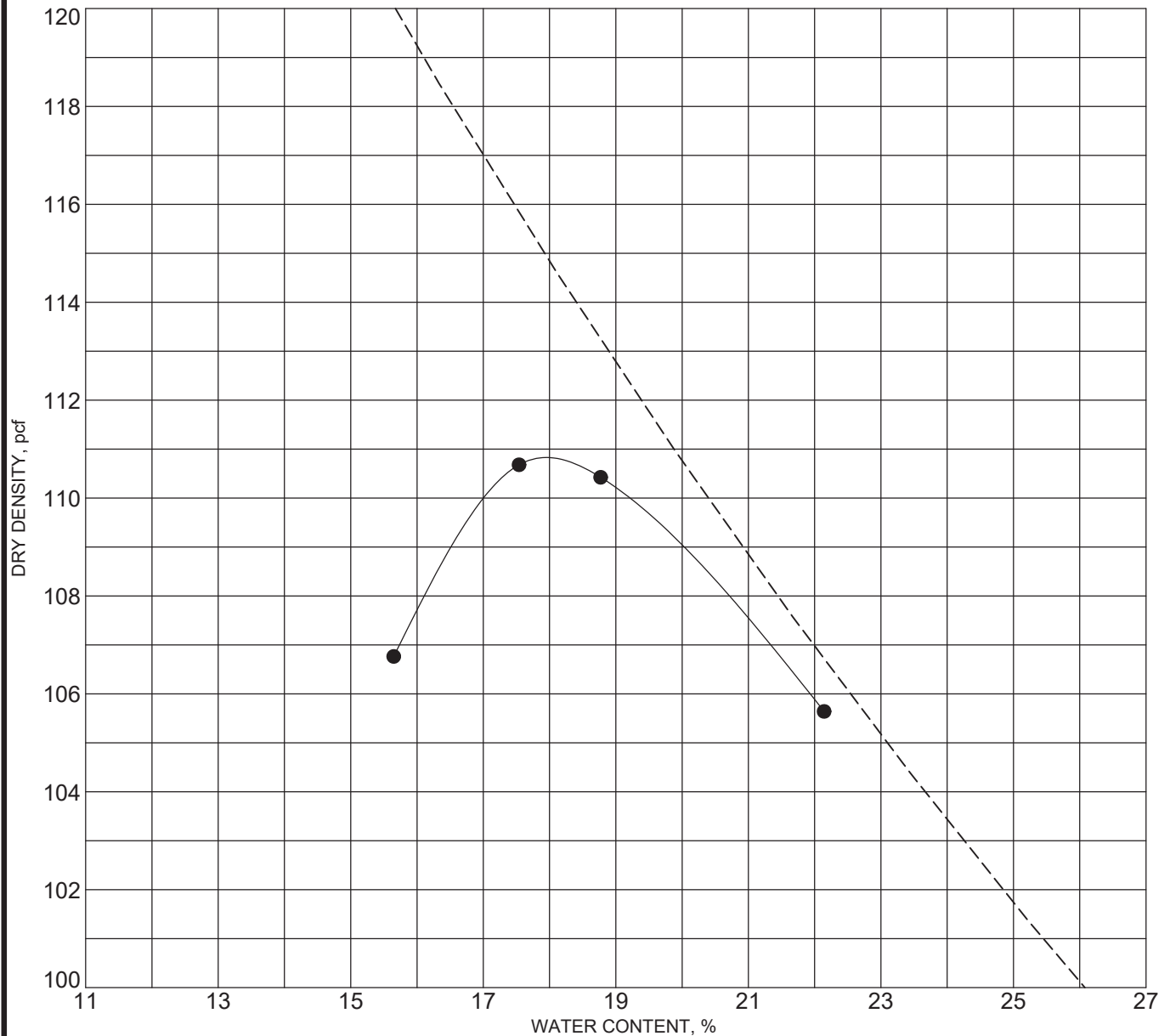


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY WITH SAND (CH), few gravel, reddish brown

Sample Source: B-13, 2.0 ft

Test Methods: ASTM D1557 Method B

Override Fraction Sieve Size: 3/8 in.

Percent Oversized Retained: 6.7%

Liquid Limit (LL): 81

Plasticity Index (PI): 52

% Retained #4 Sieve: 8.3

% Passing # 200 Sieve: 76.4

Assumed Specific Gravity: 2.75

Uncorrected Max. Dry Density (pcf): 110.8

Uncorrected Opt. Moisture (%): 18.0

Assumed Oversize Specific Gravity: 2.50

Corrected Max. Dry Density (pcf): 113.5

Corrected Opt. Moisture (%): 16.9

Comments:

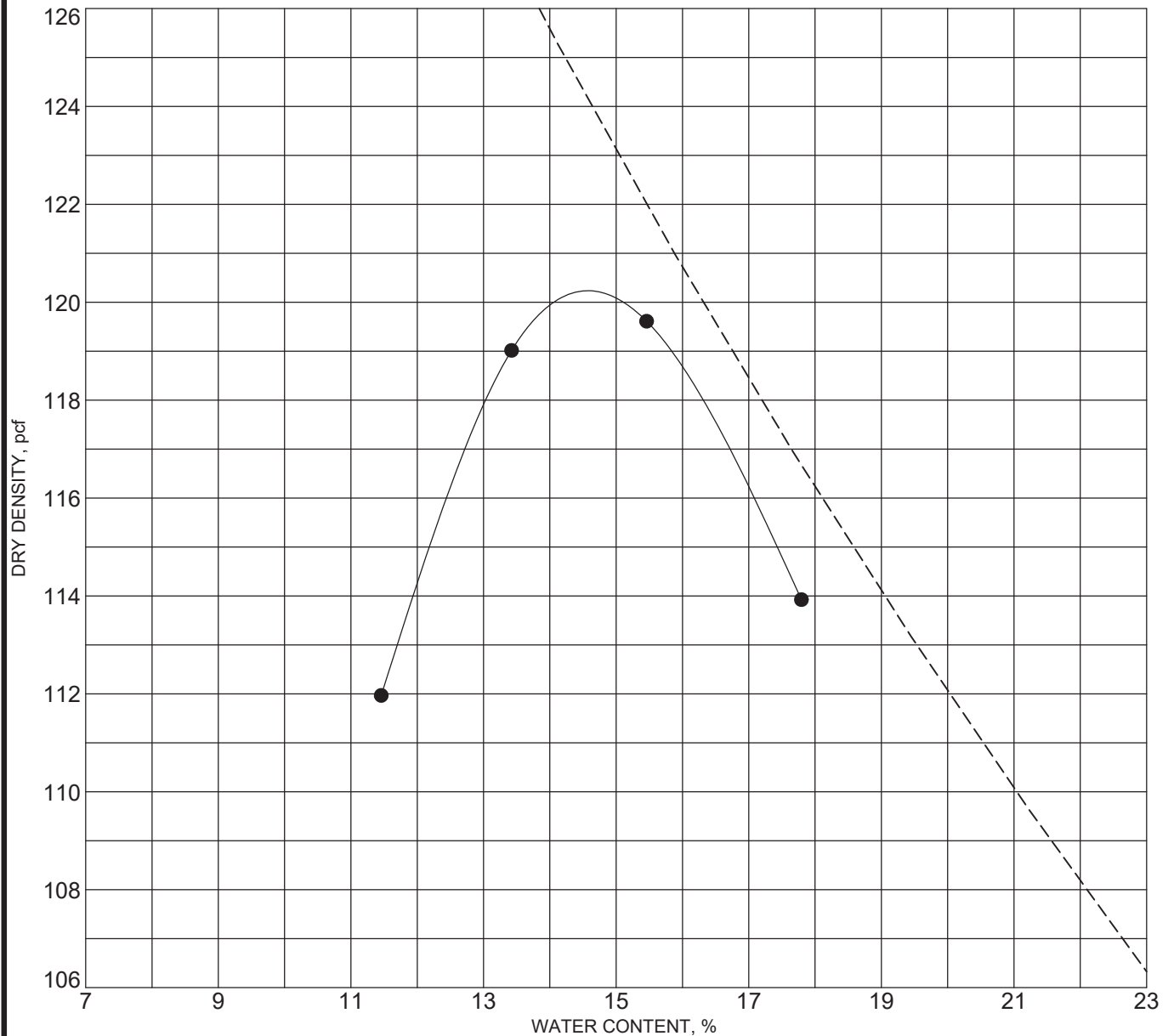


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: SANDY FAT CLAY (CH), few gravel, reddish brown

Sample Source: B-16, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.80

Max. Dry Density (pcf): 120.2

Opt. Moisture (%): 14.6

Liquid Limit (LL): 53

Plasticity Index (PI): 32

% Retained #4 Sieve: 10.0

% Passing # 200 Sieve: 65.3

Comments:

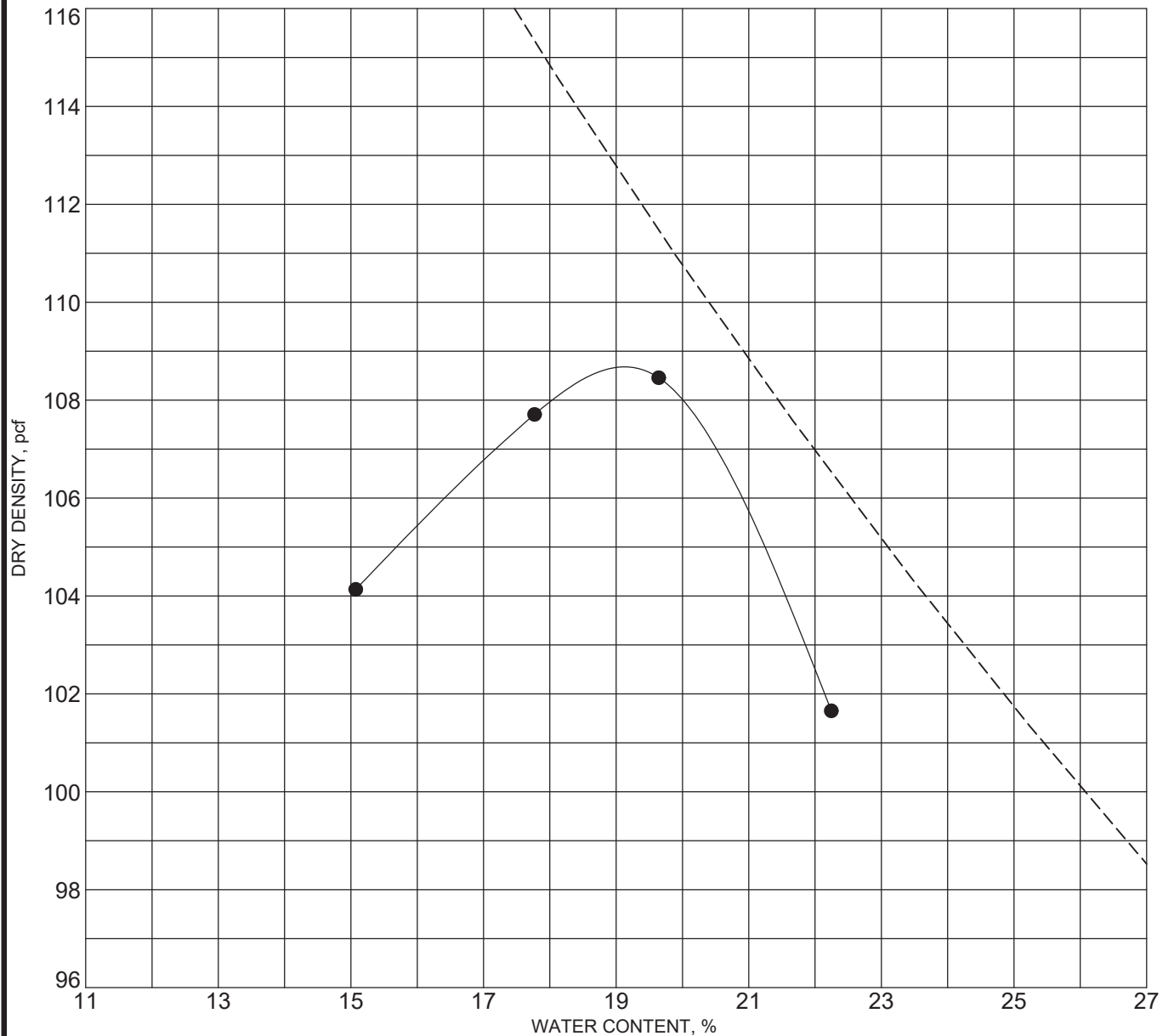


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY WITH SAND (CH), few gravel, brown

Sample Source: B-19, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 108.7

Opt. Moisture (%): 19.1

Liquid Limit (LL): 63

Plasticity Index (PI): 38

% Retained #4 Sieve: 5.3

% Passing # 200 Sieve: 77.8

Comments:

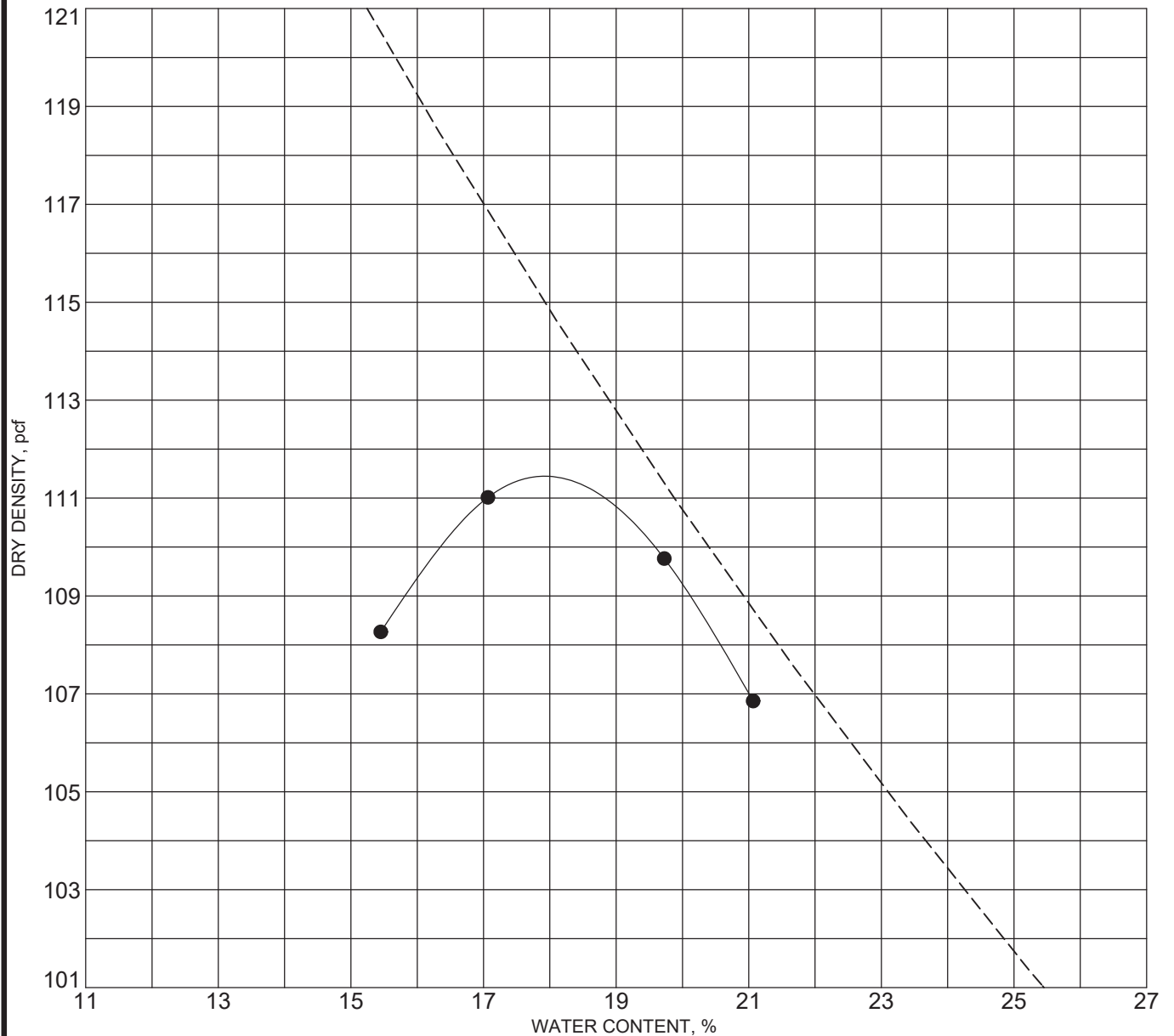


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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY WITH SAND (CH), trace gravel, orangish brown

Sample Source: B-20, 2.0 ft

Test Methods: ASTM D1557 Method B

Assumed Specific Gravity: 2.75

Max. Dry Density (pcf): 111.4

Opt. Moisture (%): 17.9

Liquid Limit (LL): 72

Plasticity Index (PI): 46

% Retained #4 Sieve: 1.7

% Passing # 200 Sieve: 80.0

Comments:



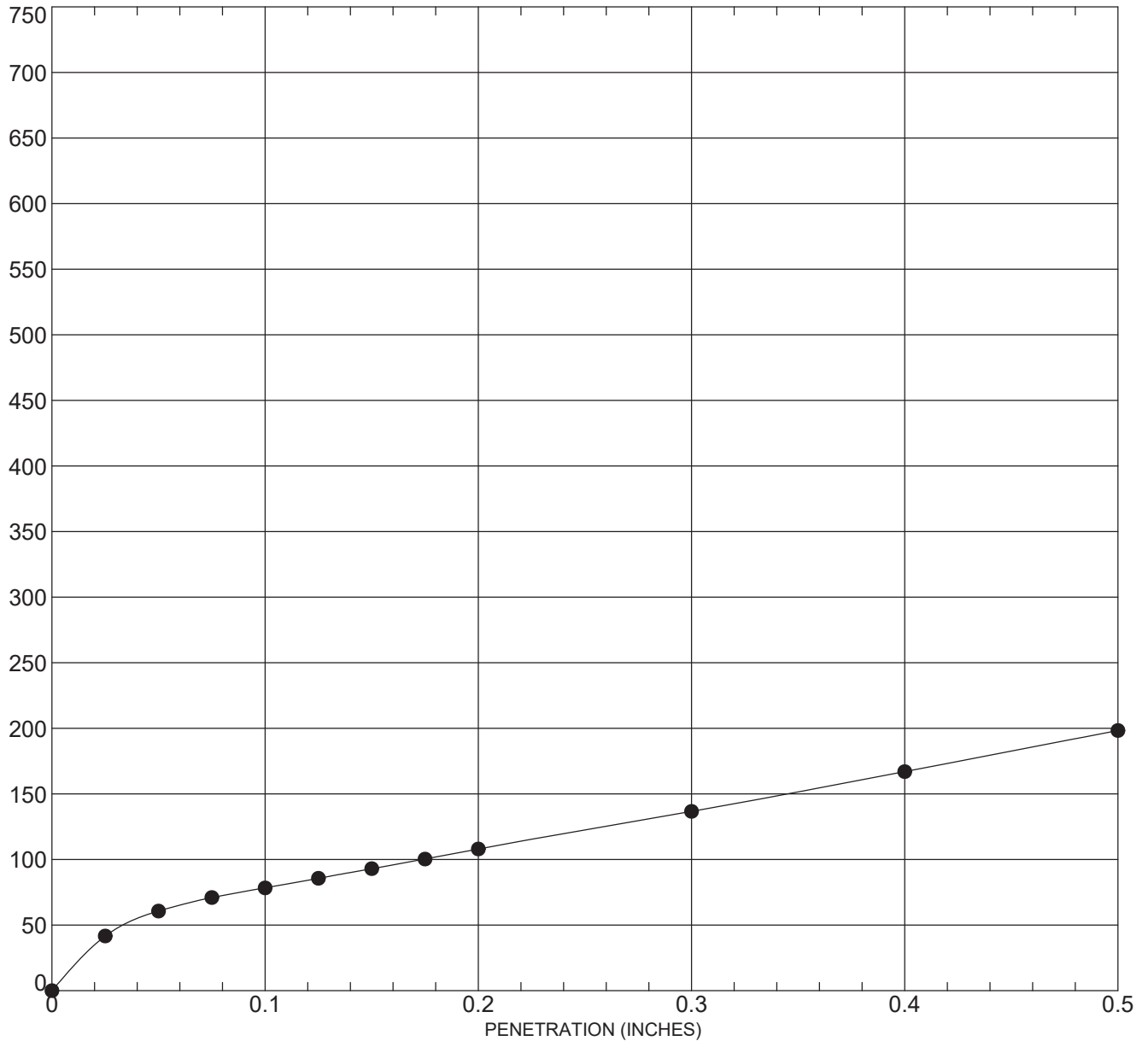
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MOISTURE DENSITY RELATIONSHIP

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



PENETRATION (INCHES)

Sample Description: FAT CLAY (CH), few sand, reddish brown

Sample Source: B-3

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 69

Plasticity Index (PI): 41

% Retained #4 Sieve: 0.0

% Passing # 200 Sieve: 88.0

Dry Density Before Soaking (pcf): 104.7

Dry Density After Soaking (pcf): 101.3

Maximum Dry Density (pcf): 107

Moisture Content Before Soaking (%): 20.9

Moisture Content After Soaking (Avg) (%): 24.9

Moisture Content Top Inch After Soak (%): 28.4

Optimum Moisture Content (%): 20.4

CBR: 7.8, Soaked

Surcharge (psf): 50

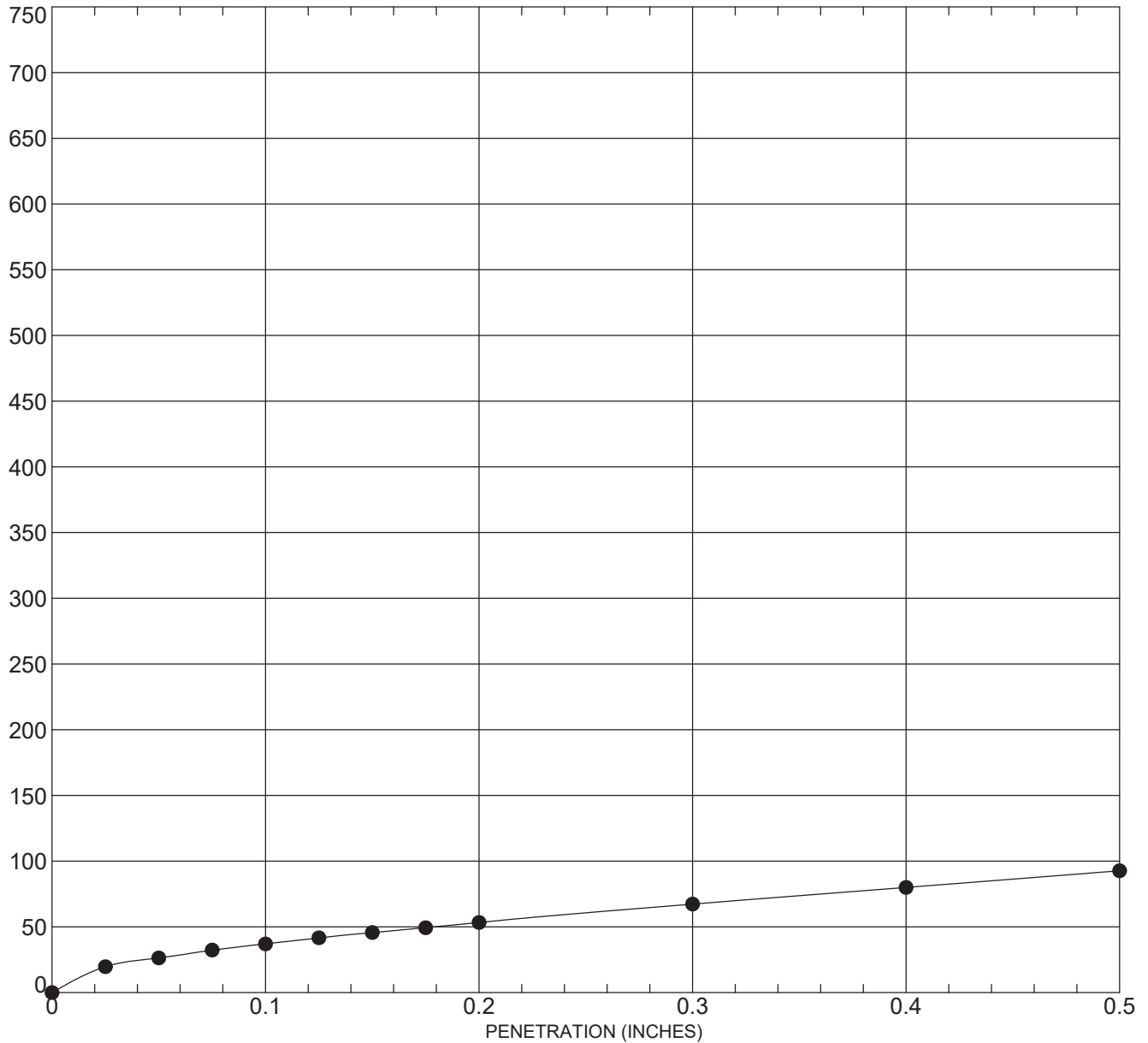
Swell (%): 3.4


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CALIFORNIA BEARING RATIO TEST
Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



PENETRATION (INCHES)

Sample Description: FAT CLAY WITH SAND (CH), few gravel,
reddish brown

Sample Source: B-4

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 86

Plasticity Index (PI): 53

% Retained #4 Sieve: 7.6

% Passing # 200 Sieve: 74.9

Dry Density Before Soaking (pcf): 106.9

Dry Density After Soaking (pcf): 98.7

Maximum Dry Density (pcf): 106.3

Moisture Content Before Soaking (%): 19.5

Moisture Content After Soaking (Avg) (%): 26.2

Moisture Content Top Inch After Soak (%): 33.2

Optimum Moisture Content (%): 20.4

CBR: 3.7, Soaked

Surcharge (psf): 50

Swell (%): 8.3



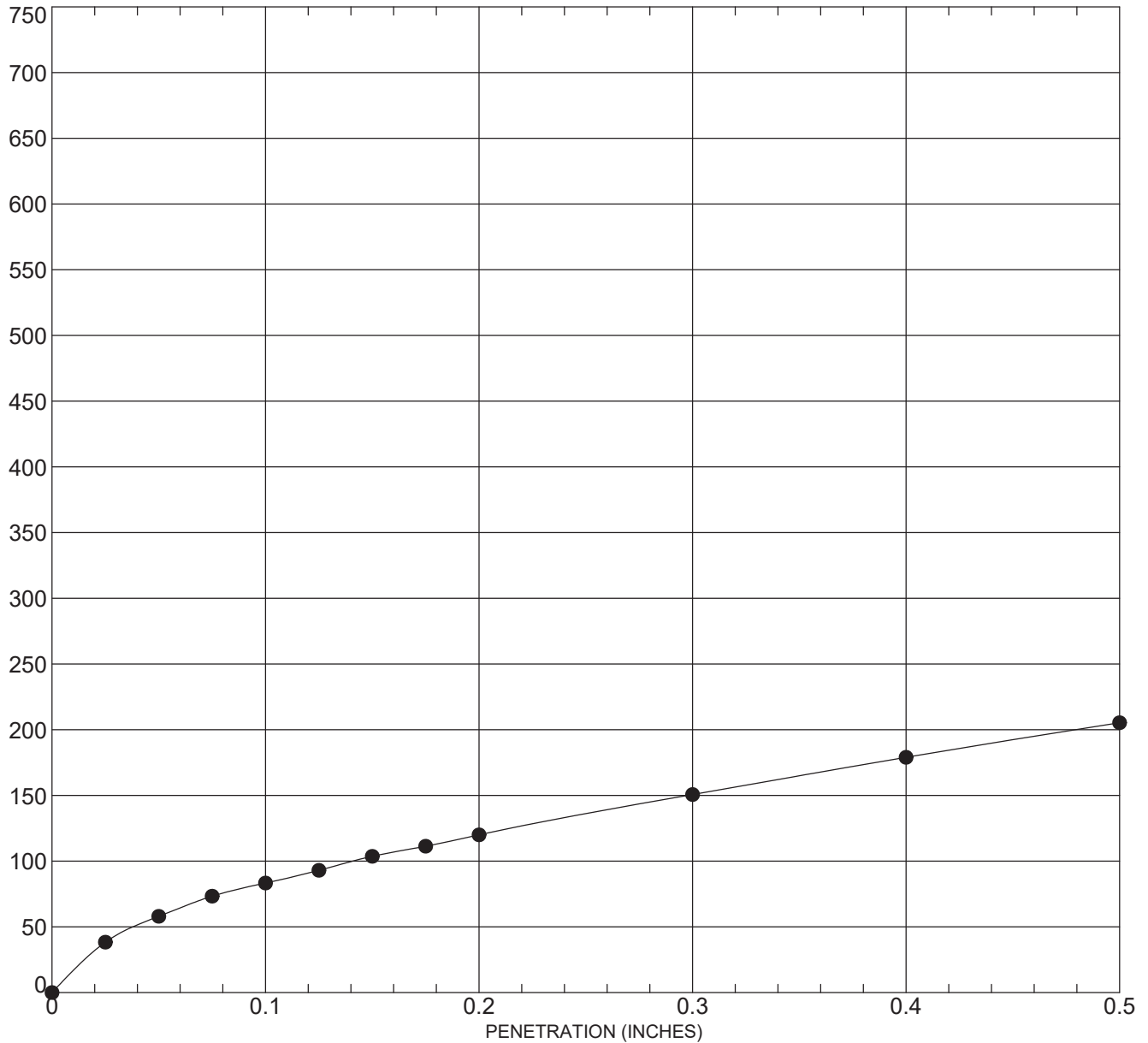
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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



Sample Description: FAT CLAY WITH SAND (CH), trace gravel, brown

Sample Source: B-5

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 55

Plasticity Index (PI): 33

% Retained #4 Sieve: 0.3

% Passing # 200 Sieve: 82.9

Dry Density Before Soaking (pcf): 115.4

Dry Density After Soaking (pcf): 111.1

Maximum Dry Density (pcf): 117.2

Moisture Content Before Soaking (%): 15.1

Moisture Content After Soaking (Avg) (%): 18.9

Moisture Content Top Inch After Soak (%): 23.5

Optimum Moisture Content (%): 15.4

CBR: 8.3, Soaked

Surcharge (psf): 50

Swell (%): 3.8



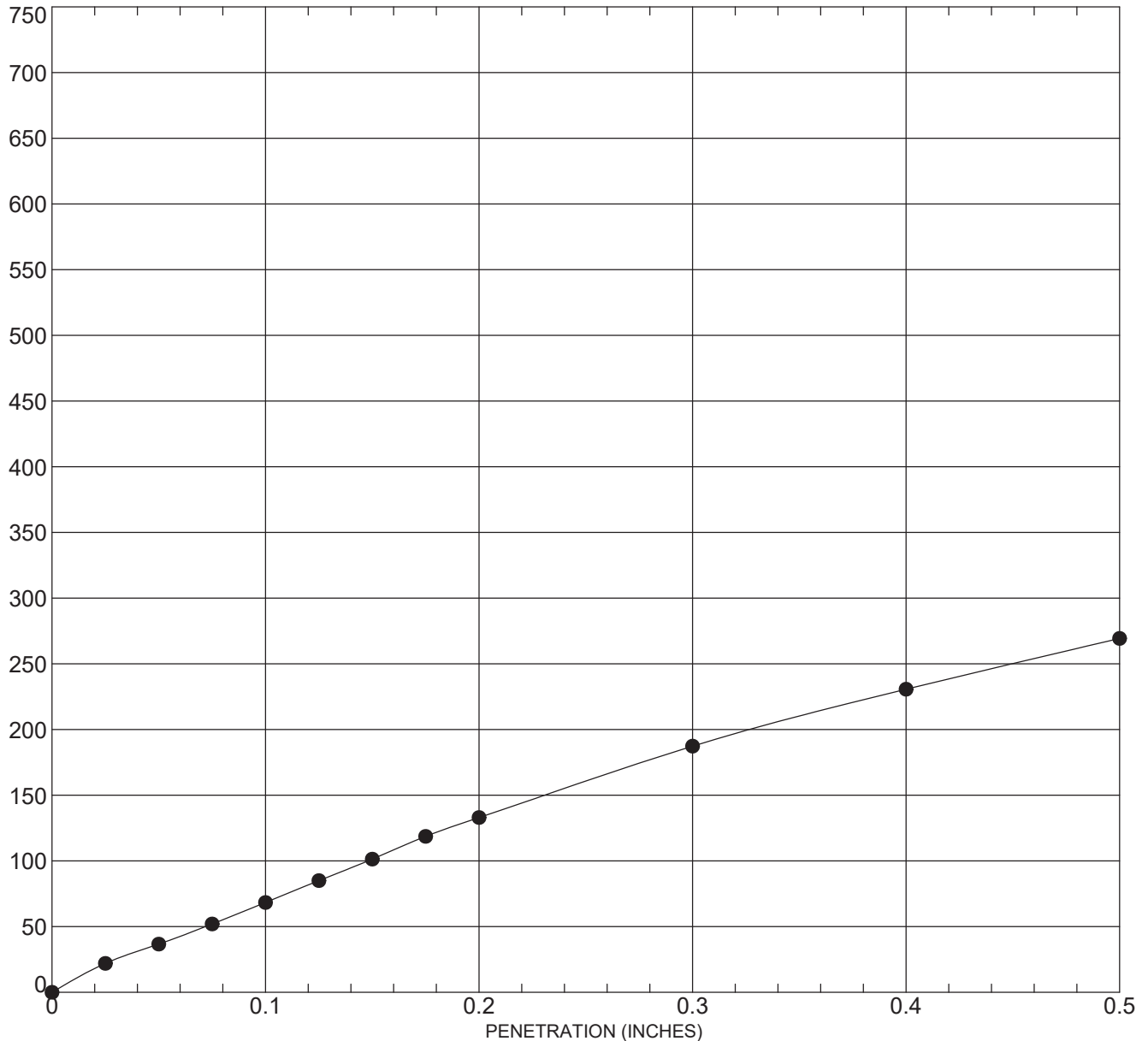
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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



Sample Description: FAT CLAY (CH), few sand, trace gravel,
orangish brown

Sample Source: B-6

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 56

Plasticity Index (PI): 30

% Retained #4 Sieve: 3.4

% Passing # 200 Sieve: 84.7

Dry Density Before Soaking (pcf): 110.5

Dry Density After Soaking (pcf): 106.5

Maximum Dry Density (pcf): 111.7

Moisture Content Before Soaking (%): 14.7

Moisture Content After Soaking (Avg) (%): 20.6

Moisture Content Top Inch After Soak (%): 25.8

Optimum Moisture Content (%): 15

CBR: 6.8, Soaked

Surcharge (psf): 50

Swell (%): 3.7



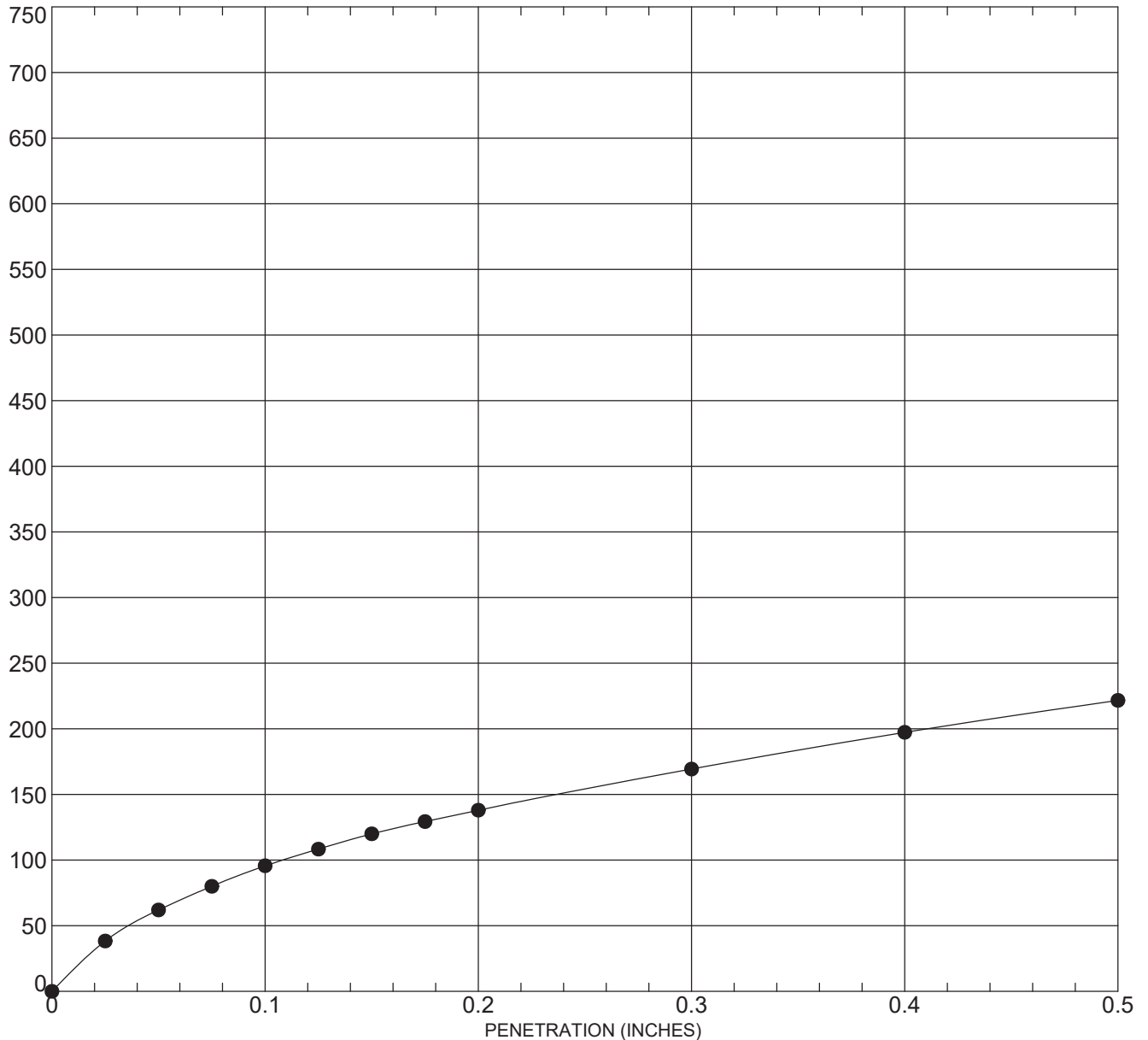
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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



Sample Description: ELASTIC SILT (MH), few sand, trace gravel, reddish brown

Sample Source: B-8
 Sample Depth: 2.0 ft
 Test Method: ASTM D1883

Liquid Limit (LL): 72
 Plasticity Index (PI): 36
 % Retained #4 Sieve: 1.5
 % Passing # 200 Sieve: 84.4

Dry Density Before Soaking (pcf): 117.8
 Dry Density After Soaking (pcf): 114.3
 Maximum Dry Density (pcf): 119.3
 Moisture Content Before Soaking (%): 13.2
 Moisture Content After Soaking (Avg) (%): 17.3
 Moisture Content Top Inch After Soak (%): 20.8
 Optimum Moisture Content (%): 13.7

CBR: 9.6, Soaked
 Surcharge (psf): 50
 Swell (%): 3.0



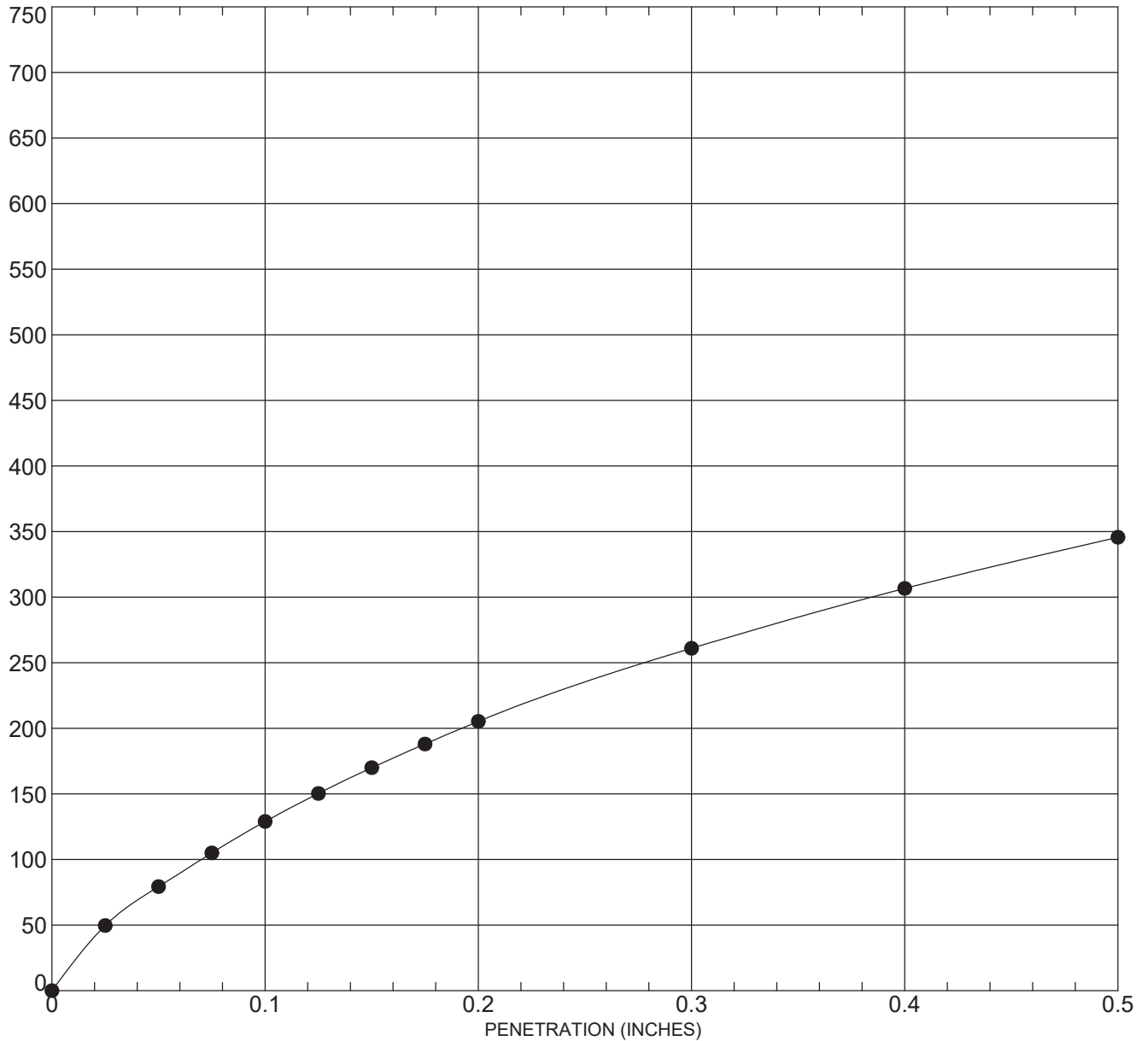
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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
 Runway 6-24 Rehabilitation
 Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



PENETRATION (INCHES)

Sample Description: FAT CLAY WITH SAND (CH), trace
gravel, reddish brown

Sample Source: B-11

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 64

Plasticity Index (PI): 36

% Retained #4 Sieve: 2.1

% Passing # 200 Sieve: 84.7

Dry Density Before Soaking (pcf): 107.0

Dry Density After Soaking (pcf): 105.5

Maximum Dry Density (pcf): 108.2

Moisture Content Before Soaking (%): 20.1

Moisture Content After Soaking (Avg) (%): 22.2

Moisture Content Top Inch After Soak (%): 24.6

Optimum Moisture Content (%): 19.2

CBR: 12.9, Soaked

Surcharge (psf): 50

Swell (%): 1.4



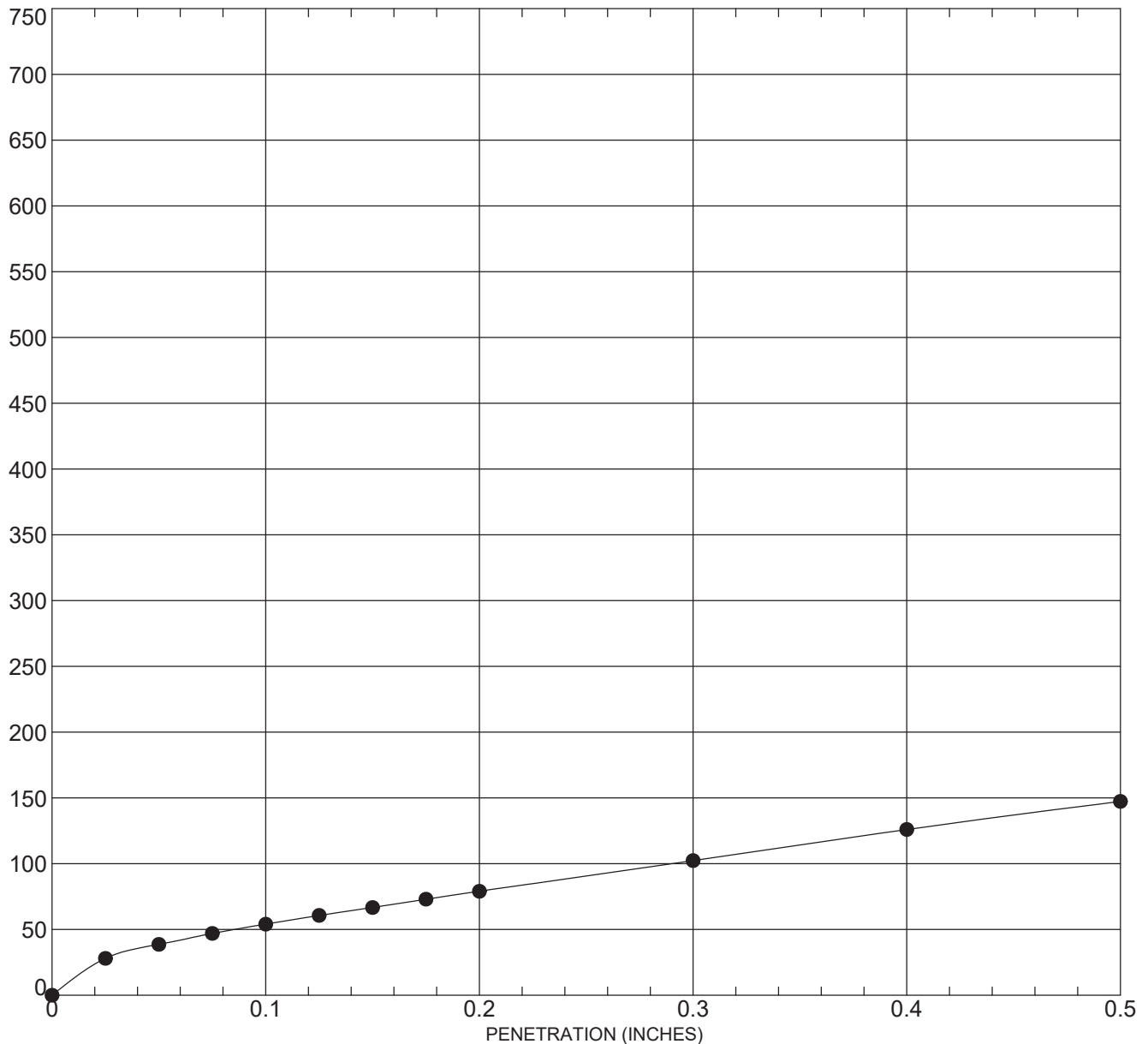
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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



Sample Description: FAT CLAY WITH SAND (CH), few gravel, reddish brown

Sample Source: B-13

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 81

Plasticity Index (PI): 52

% Retained #4 Sieve: 8.3

% Passing # 200 Sieve: 76.4

Dry Density Before Soaking (pcf): 108.9

Dry Density After Soaking (pcf): 103.7

Maximum Dry Density (pcf): 110.8

Moisture Content Before Soaking (%): 18.3

Moisture Content After Soaking (Avg) (%): 23.5

Moisture Content Top Inch After Soak (%): 27.9

Optimum Moisture Content (%): 18

CBR: 5.4, Soaked

Surcharge (psf): 50

Swell (%): 5.0



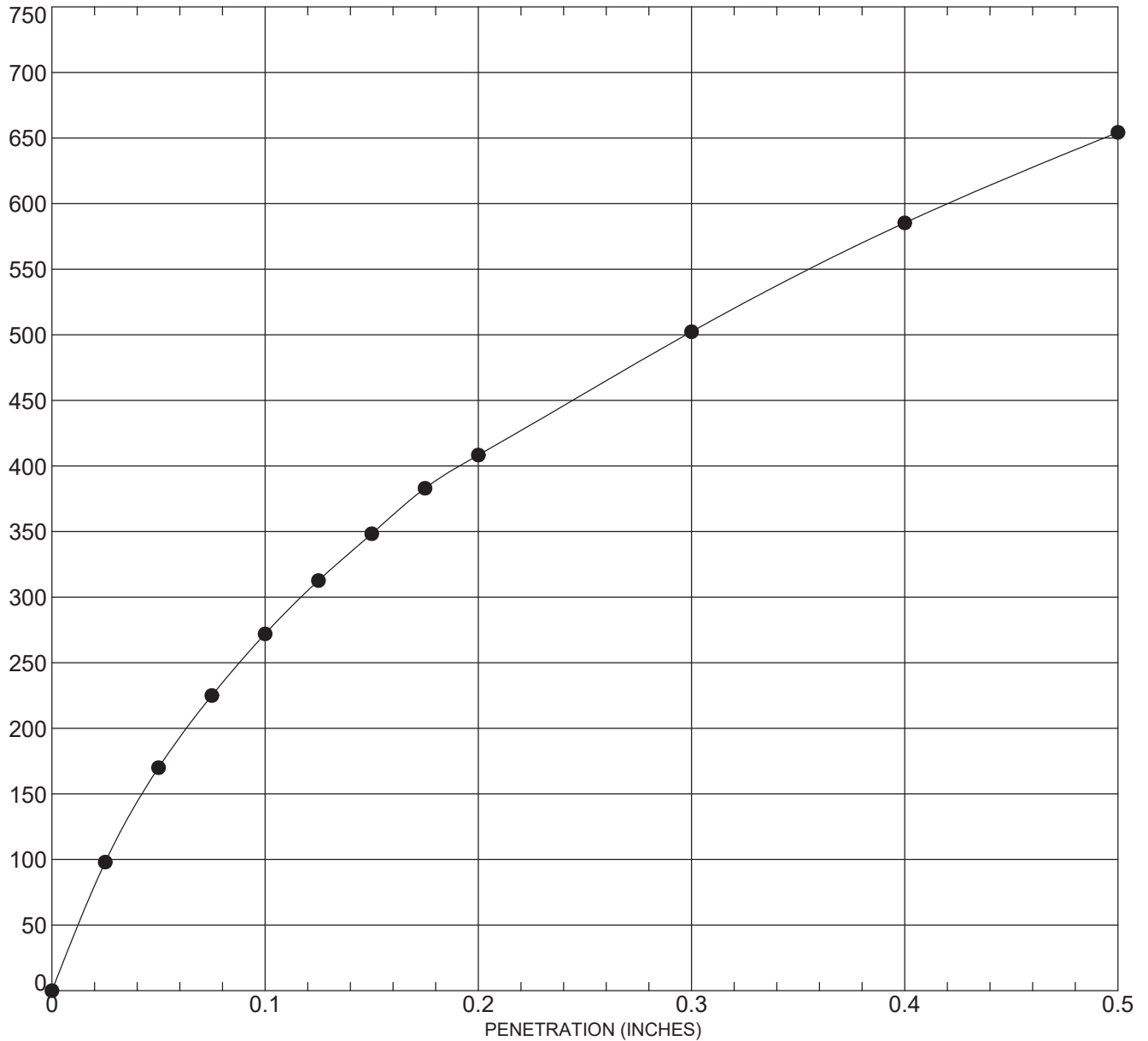
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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



PENETRATION (INCHES)

Sample Description: SANDY FAT CLAY (CH), few gravel,
reddish brown

Sample Source: B-16

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 53

Plasticity Index (PI): 32

% Retained #4 Sieve: 10.0

% Passing # 200 Sieve: 65.3

Dry Density Before Soaking (pcf): 119.3

Dry Density After Soaking (pcf): 118.6

Maximum Dry Density (pcf): 120.2

Moisture Content Before Soaking (%): 14.9

Moisture Content After Soaking (Avg) (%): 16.1

Moisture Content Top Inch After Soak (%): 17.5

Optimum Moisture Content (%): 14.6

CBR: 27.2, Soaked

Surcharge (psf): 50

Swell (%): 0.5

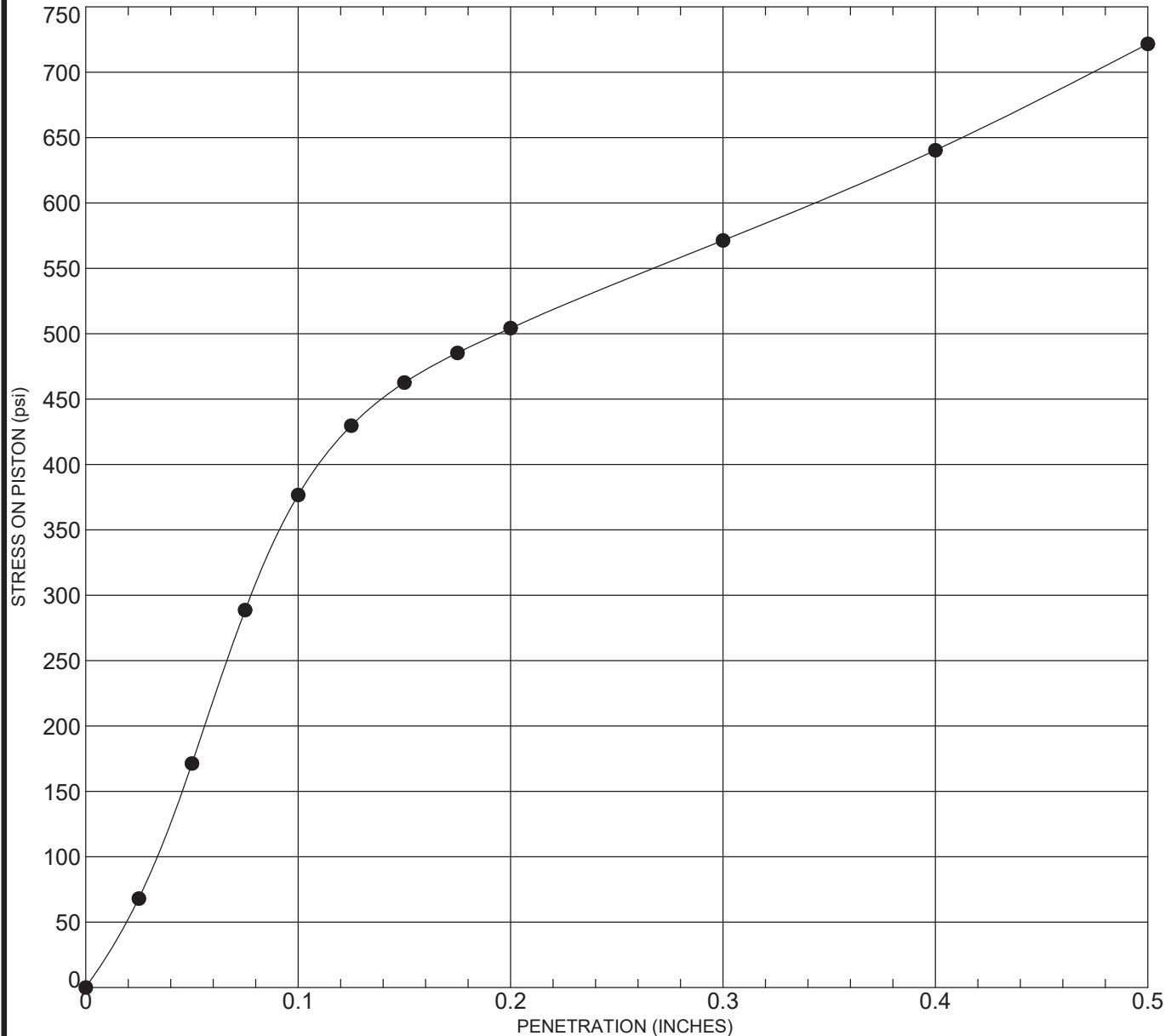


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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC



Sample Description: FAT CLAY WITH SAND (CH), few gravel, brown

Sample Source: B-19

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 63

Plasticity Index (PI): 38

% Retained #4 Sieve: 5.3

% Passing # 200 Sieve: 77.8

Dry Density Before Soaking (pcf): 108.0

Dry Density After Soaking (pcf): 106.8

Maximum Dry Density (pcf): 108.7

Moisture Content Before Soaking (%): 18.6

Moisture Content After Soaking (Avg) (%): 21.5

Moisture Content Top Inch After Soak (%): 25.2

Optimum Moisture Content (%): 19.1

CBR: 40.8, Soaked

Surcharge (psf): 50

Swell (%): 1.2



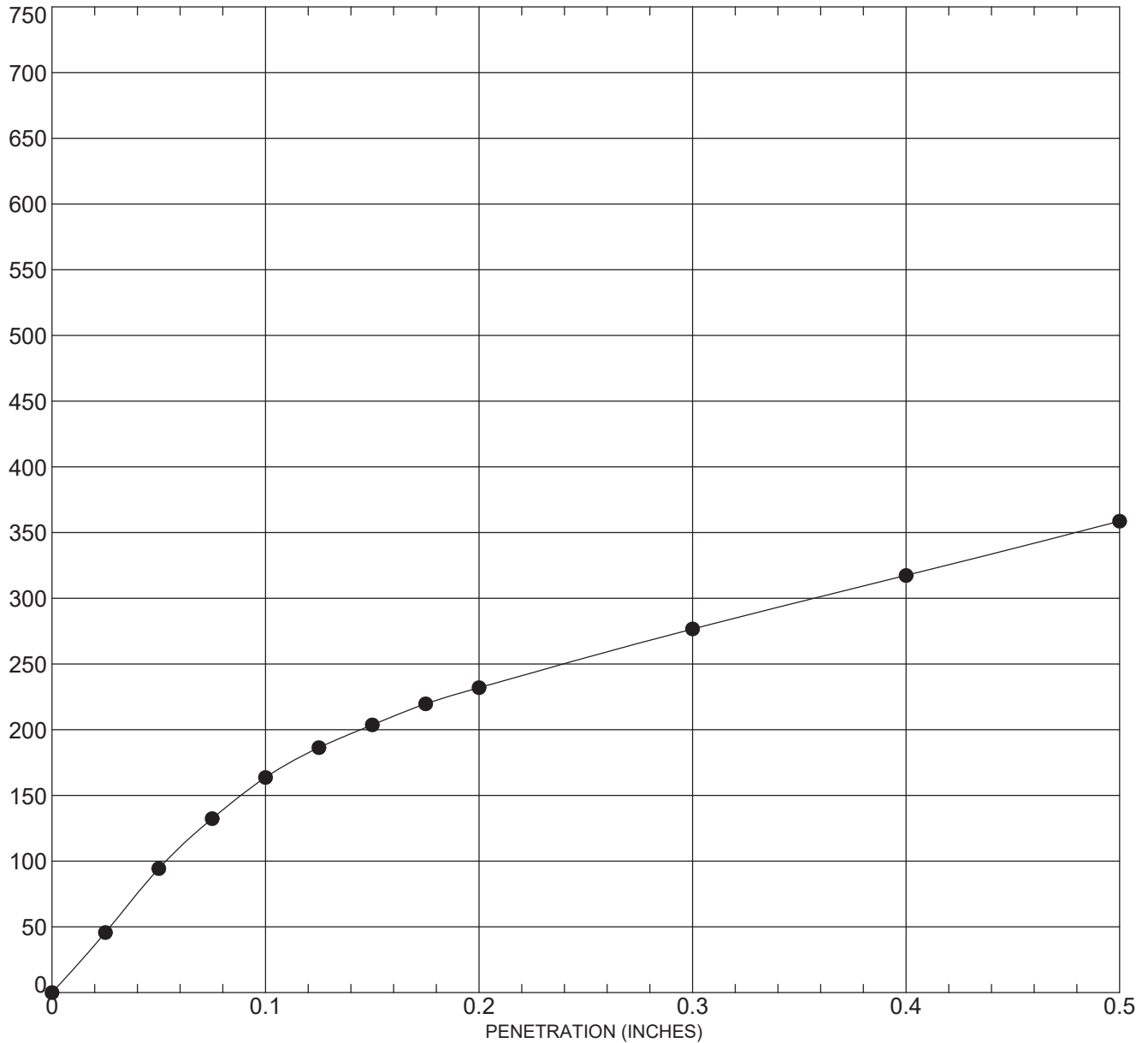
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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC

STRESS ON PISTON (psi)



PENETRATION (INCHES)

Sample Description: FAT CLAY WITH SAND (CH), trace gravel, orangish brown

Sample Source: B-20

Sample Depth: 2.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 72

Plasticity Index (PI): 46

% Retained #4 Sieve: 1.7

% Passing # 200 Sieve: 80.0

Dry Density Before Soaking (pcf): 110.0

Dry Density After Soaking (pcf): 107.9

Maximum Dry Density (pcf): 111.4

Moisture Content Before Soaking (%): 17.6

Moisture Content After Soaking (Avg) (%): 21.0

Moisture Content Top Inch After Soak (%): 24.4

Optimum Moisture Content (%): 17.9

CBR: 16.7, Soaked

Surcharge (psf): 50

Swell (%): 2.0



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CALIFORNIA BEARING RATIO TEST

Project: Roanoke-Blacksburg Regional Airport
Runway 6-24 Rehabilitation
Roanoke, Virginia

Contract: 23160097.000 **Testing Lab:** BLAC