SECTION IV

GENERAL CONSTRUCTION ITEMS

CERTIFICATION PAGE

The documents for this Project were prepared by me or under my direct supervision:

Technical Specifications: E-020, C-100, C-102, C-105, C-110, E-110, E-180, E-190, P-101, P-152, P-153, P-154, P-208, P-209, P-401, P-602, P-603, P-605, P-608, P-610, P-620, D-701, D-705, D-751, F-162, T-901

Pages or sheets covered by this seal:

Drawings: 1-48 AND 49-102

EASTERN OREGON REGIONAL AIRPORT
PENDLETON, OREGON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

PRECISION APPROACH ENGINEERING, INC.
March 2022

CERTIFICATION PAGE

The documents for this Project were prepared by me or under my direct supervision:

Technical Specifications: E-800, L-108, L-109, L-110, L-115 and L-125

Pages or sheets covered by this seal:

Drawings: 49-67

EASTERN OREGON REGIONAL AIRPORT
PENDLETON, OREGON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

PRECISION APPROACH ENGINEERING, INC.
March 2022

ITEM E-020 GENERAL REQUIREMENTS

020-1.1 This item shall consist of preparatory work, furnishing submittals, and other operations, including, but not limited to, work necessary to set up barricades, complete utility locates; set up and dismantle all temporary offices, buildings, facilities, and utilities; and perform site restoration and cleanup. This item shall also include all items required for construction phasing and safety during construction of this project, whether specified on the drawings or not. In addition, included shall be all costs associated with shutdowns outlined on the drawings or shown in the specifications. No additional compensation shall be due Contractor for planned shutdowns.

020-1.2 This item shall also include all work required for construction survey and staking, as well as location or identification of existing utilities.

20-2.1 LOCATION AND DRAWINGS.

a. Location. The location of the work is at the **EASTERN OREGON REGIONAL AIRPORT, Pendleton, Oregon**. A vicinity map is shown on Sheet 1 of the Drawings.

b. Drawings. The Drawings for the construction of "**Runway 29 Threshold Relocation, New Taxilanes and Apron Rehabilitation**" Airport Improvements Program, AIP Project No. **3-41-0046-028-2020 and 3-41-0046-030-2022**, consist of 102 sheets, and dated March 2022.

020-3.1 DISPOSAL. All materials shall be disposed of offsite, unless otherwise shown on the drawings. Arrangements for the disposal of all other materials shall be made by the Contractor. No direct payment will be made for disposal of unused materials.

020-4.1 SITE INVESTIGATION AND REPRESENTATION. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon availability of transportation, disposal, handling, and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the prosecution of the work, and all other matters which can in any way affect the work or the cost thereof under this Contract.

a. The Contractor further acknowledges that he has satisfied himself as to the character, quality, and quantity of surface and subsurface materials to be encountered from inspecting the site, all exploratory work done by the Owner, as well as from information presented by the Drawings and Specifications made a part of this Contract. Any failure by the Contractor to acquaint himself with all the available information will not relieve him from the responsibility for properly estimating the difficulty or cost of successfully performing the work.

b. The Contractor warrants that as a result of his examination and investigation of all the aforesaid data, he can perform the work in a good and workmanlike manner and to the satisfaction of the Owner. The Owner assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this Contract, unless (1) such representations are expressly stated in the Contract, and (2) the Contract expressly provides that the responsibility therefore is assumed by the Owner. Representations for which liability is not expressly assumed by the Owner in the Contract shall be deemed only for the information of the Contractor.

c. Dewatering. It is anticipated that dewatering will be required to lower the water table, remove standing water, or lower the moisture content of soils encountered to achieve workability and compaction. In addition, dewatering may be required to properly grade ditches, lay pipe or cable in trenches, or for making foundations suitable for embankment or base materials. Soft or yielding materials which can be stabilized by dewatering shall not be classified as unsuitable foundation. No direct payment for dewatering shall be made and all costs incurred shall be considered as incidental to the appropriate bid items.

020-5.1 FIRE PREVENTION AND PROTECTION. The Contractor shall perform all work in a fire-safe manner. He shall supply and maintain on the site adequate fire-fighting equipment capable of extinguishing incipient fires. The Contractor shall comply with applicable local and state fire prevention regulations and where the regulations do not

cover, with applicable parts of the National Fire Prevention Standard for "Safeguarding Building Construction Operations," (NFPA No. 241).

020-6.1 GENERAL CONSTRUCTION RESPONSIBILITIES AND PROCEDURES.

a. Haul Routes and Maintenance. Any haul roads and access roads shall be constructed by the Contractor at his expense. The Contractor shall perform all necessary maintenance of haul routes during construction and shall perform all work as necessary to restore the routes used by his equipment to their original condition at the conclusion of construction. New roadways shall be obliterated and original vegetation reestablished. Existing roadways, runways, taxiways, and aprons shall be patched or overlaid as necessary to restore them to original condition.

Haul routes shall be sprinkled with water as necessary to prevent dust diffusion during the course of the work. Should soil conditions require gravel placement to maintain a satisfactory haul road, it shall be done at the Contractor's expense.

Turfed areas surrounding roadways, runways, taxiways, and aprons that are disturbed as a result of the Contractor's operations shall be restored to their original condition.

All maintenance and restoration work shall be completed to the RPR's satisfaction before final payment is awarded. No direct payment will be made for this work.

b. Responsibility for damage to existing structures. Where any existing structures or facilities which are intended to remain are damaged by the Contractor during demolition or construction, the Contractor shall promptly repair or replace the damaged portion or facility at his expense.

MATERIALS

020-7.1 SUBMITTALS AND CERTIFICATIONS. As required by the Specifications or shown on the Drawings, the Contractor shall submit material submittals, furnish shop drawings, and furnish material certifications.

a. The date when the Contractor provides the submittal(s) to the RPR shall be included in the Contractor’s project schedule. All submittals shall have assigned due dates that correspond with approved schedule start dates for related activities allowing a minimum fifteen (15) calendar days, or otherwise specified in the Specifications, for the RPR’s review as well as adequate time for fabrication and delivery of the material. The RPR shall not be held responsible for late or inadequate submittals provided by the Contractor. Materials shall not be incorporated into the work without the submittal, shop drawing, or material certification reviewed by the RPR.

b. Prior to submission, the Contractor shall review each submittal and indicate with signature on an original letter that they have reviewed and approved the submittal and that it conforms to the Contract Documents. If this original letter is not included, the submittal and/or shop drawing will be returned without any action by the RPR.

Submittal data shall be presented in a clear, precise, and thorough manner. Original catalog sheets are preferred, however, photocopies are acceptable provided they are of good quality and legible. The Contractor shall clearly and boldly mark each copy to identify pertinent products or models applicable to the project. At the time of each submittal, the Contractor shall identify any proposed deviations or substitutions from the Contract Documents.

Review by the RPR is only for conformance with the Contract Documents. Review does not cover dimensions, quantities, accuracy, fit, compatibility or any assembly for which the item under review may be a component. Review action does not authorize deviation from Contract Documents or substitution of materials.

c. The RPR will complete the review within a reasonable period of time depending upon the size, complexity and number of submittals received. Every effort will be made to review submittals within ten (10) calendar days of receipt by the RPR, however, the RPR will not be responsible for any project impacts should the review period exceed the ten (10) calendar days.

020-7.2 TEMPORARY FACILITIES. The Contractor shall provide all temporary facilities as required for performing the work.

020-7.3 TEMPORARY WATER. The Contractor shall make all arrangements for obtaining water and pay all costs for same. Water shall be potable water obtained from a municipal source or well. The use of reclaimed water is not allowed. The use of additives, such as chemicals, abrasive materials, detergents, or salt water is not allowed.

020-7.4 TEMPORARY ELECTRIC POWER. The Contractor shall make all arrangements for electric power for use during the construction period until final acceptance by the Owner, and pay all costs for same.

020-7.5 SECURITY FENCING. Construct a temporary security fence around the Contractor's staging area. Maintain the fence during construction period and provide security for the Contractor's existing materials and facilities.

020-7.6 PARKING FACILITIES. Provide parking facilities for personnel working on the project. Employee or equipment parking will be permitted only in areas specifically designated for the Contractor's use. No employee-owned vehicles shall be permitted within the airside area of the airport.

020-7.7 RECORD DRAWINGS. The Contractor shall maintain a set of full size drawings on site noting changes in project layout, details, and other information shown on the drawings. Record drawings shall contain the names, addresses, and phone numbers of the Prime Contractor and Subcontractors used.

020-7.8 CONSTRUCTION SURVEY AND STAKING. The Contractor shall perform all survey activities necessary to control the many phases of work required to construct the Project to the lines and grades as shown, established, or specified in the Specifications or shown on the Drawings. The survey shall be conducted by a surveyor licensed in the State of Oregon and conducted under the supervision of a PLS.

020-7.9 CONTRACTOR'S STAGING AREA. An area has been set aside on the Owner's property for the Contractor's use as a staging area for personnel, equipment, and materials. The approximate site location is shown on the Drawings. The RPR will define the actual location in the field. In the event additional space is required for the Contractor's operations, the Contractor shall make arrangements with the Owner. The staging area shall be kept in a neat and orderly condition. The area shall be restored to its original condition at the conclusion of the work.

020-7.10 SAFETY PLAN COMPLIANCE DOCUMENT. The Contractor shall submit and comply with a Safety Plan Compliance Document (SPCD) as required in the Construction Safety and Phasing Plan. The SPCD shall incorporate the requirements of the Construction Safety and Phasing Plan (CSPP)

020-7.11 RADIO. The Contractor shall provide a minimum of two radios, one carried by the safety officer and the other by the Superintendent, unless otherwise agreed to with the RPR and Owner. The radios shall have dual power source; i.e., battery and a car/truck plug in, and be capable of communication on the airport VHF frequency (See CSPP). Radio checks shall be made daily as coordinated with the RPR and Owner.

CONSTRUCTION METHODS

020-8.1 LAYOUT OF TEMPORARY FACILITIES. Set up construction facilities in a neat and orderly manner within designated area. Accomplish all required work in accordance with applicable portions of these Specifications, or as approved. Confine operations to work area shown.

020-8.2 OBSTRUCTIONS. Some obstructions may not be shown. Bidders are advised to carefully inspect the existing facilities before preparing their bids (proposals). The removal of minor obstructions such as rocks and other debris shall be anticipated and accomplished, even though not shown or specifically mentioned.

020-8.3 TEMPORARY SHUTDOWN. The Contractor shall cease operations during periods indicated on the drawings. During this time, the Contractor shall secure all materials within the staging area, set up barricades, cones, or other safety measures as specified or as directed by the RPR.

020-8.4 RECORD DRAWINGS, TEST RESULTS, SURVEY NOTES AND QUANTITY COMPUTATIONS. At the conclusion of the work, the Contractor shall furnish the RPR with one set of record drawings. This shall be a full-size set of Contract drawing prints accurately marked to reflect current conditions or any changes in geometric layout of project items, changes in details, drainage structure grade and invert elevations, and changes in work that occurred during the course of the project. The Contractor shall provide a report containing all test results, separated by material

type as required by the specifications and a copy of all survey notes and computations made in connection with the work to the RPR.

The Contractor shall furnish the RPR with survey notes of "finish grades" for all improvement in this project. The data shall include as a minimum:

1. Elevations at centerline, all lateral grade breaks, drainage swales, and outside edges of pavement every 50 feet for newly paved or newly constructed areas.

2. Edge of pavement in new pavement areas.

3. Location, rim elevations, and inverts of new or raised cleanouts, drainage structures, catch basins and manholes.

4. Elevation and location of all survey reference points or any new disturbed, or replaced, benchmark or control point.

5. Any work performed by change order that can be reflected in the Drawings.

The Contractor shall provide a complete summary of all drawings, diagrams, notes, calculations and computations used to determine measurement for pay quantities and submit them to the RPR with each payment request.

Final payment will not be made until the "record drawings", survey data, test results, and all other items under this specification have been submitted.

020-8.5 COVID-19 JOB SITE REQUIREMENTS. The Contractor and their sub-contractors shall comply with and demonstrate how they will meet and maintain all required local, state, and federal requirements in effect during the period of performance of construction related to the novel Coronavirus (COVID-19) pandemic. It is anticipated that this will require the Contractor to have site specific safety plans, regular pre-activity meetings to ensure compliance with these standards, and a site-specific COVOD-19 Supervisor at the job site to monitor the health of employees and enforce the Contractor's COVID-19 job site safety plan. Construction shall not commence until the Contractor can meet and maintain all requirements, including providing materials, schedules and equipment required to comply. The Contractor shall submit documentation of compliance with the requirements to the RPR prior to beginning construction.

METHOD OF MEASUREMENT

020-9.1 No direct measurement for work specified under Section GENERAL REQUIREMENTS shall be made with the exception of Construction Survey and Staking.

020-9.2 The measurement for the quantity of Construction Survey and Staking shall be partial payments and 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, delivery of all Project Closeout materials as required by GP 90-11, the final 10%.

BASIS OF PAYMENT

020-10.1 No direct payment for work specified under Section GENERAL REQUIREMENTS shall be made with the exception of Construction Survey and Staking. Payment for work specified under Section GENERAL REQUIREMENTS, with the exception of Construction Survey and Staking, shall be considered incidental to the Contract price.

020-10.2 Payment shall be made at the Contract lump sum for Construction Survey and Staking. This price shall be full compensation for all construction surveying, for furnishing all materials, labor, equipment, tools, submittal of all required documentation, and incidentals necessary to complete the item.

Payment will be made under:

Bid Item No. 1	Construction Survey and Staking - per Lump Sum
Bid Item No. A-1	Construction Survey and Staking - per Lump Sum

CONSTRUCTION SAFETY AND PHASING PLAN (CSPP)

RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

AIRPORT IMPROVEMENT PROGRAM
3-41-0046-028-2020
3-41-0046-030-2022

EASTERN OREGON REGIONAL AIRPORT
Pendleton, Oregon

Prepared by:

PRECISION APPROACH ENGINEERING, INC.
5125 SW Hout Street
Corvallis, OR 97333

MARCH 2022

PRECISION APPROACH ENGINEERING

EASTERN OREGON REGIONAL AIRPORT

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EASTERN OREGON REGIONAL AIRPORT (PDT)
RUNWAY 29 THRESHOLD RELOCATION,
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Pendleton, Oregon

CONSTRUCTION SAFETY AND PHASING PLAN (CSPP)

2.1 OVERVIEW. Aviation safety is the primary consideration at airports, especially during construction. The Airport Operator's Construction Safety and Phasing Plan and the contractor's Safety Plan Compliance Document (SPCD) are the primary tools to ensure safety compliance when coordinating construction activities with airport operations. These documents identify aspects of the construction project that pose a potential safety hazard to airport operations and outline mitigation procedures for each hazard. They provide information necessary for the Airport Operations department to conduct airfield inspections and identify and correct unsafe conditions during construction. Aviation safety provisions included within the project drawings, contract specifications, and other related documents are included in the CSPP and SPCD by reference.

The following sections are numbered to correlate with the main paragraphs in the current Construction Safety and Phasing Plan Advisory Circular 150/5370-2G, Chapter Two.

1. **Project Description.** The purpose of this project is to:
    - Runway 29 threshold relocation – mitigation of a currently documented FAA Hot Spot associated with the current runway threshold location
        - Associated storm drainage improvements
        - RW and TW RSA and shoulder grading
        - Taxiway and Runway 29 associated electrical improvements – RW 29 MIRL, RW 11-29 Distance Remaining Signs, RW 29 REIL (PDT owned), RW 29 PAPI (PDT owned)
        - Relocation of UAS support vehicle routing outside of RW 29 RSA – Improvements of perimeter access road
    - Construct New Taxilanes
    - Rehabilitation of existing apron and taxilane pavements

2.2 ASSUME RESPONSIBILITY. The Airport Operator has submitted this CSPP for Federal Aviation Administration (FAA) approval. It is the Contractor's responsibility to apply the requirements of the FAA approved CSPP. The Contractor must revise the CSPP when conditions change. Revisions to the CSPP must be submitted to the Airport Operator for FAA approval prior to implementing any changes.

This CSPP, ASN #'s 2022-ANM 570 thru 579 -NRA, are currently pending approval.

2.3 SUBMIT THE CSPP.

1. Submit Outline - Not Used

2. Submit CSPP – The CSPP was sent to FAA with the 95% drawing submittal.

3. Submit an SPCD. The Contractor shall submit the SPCD to the Airport Operator and Engineer for review prior to the Notice to Proceed unless otherwise approved by the Engineer. The plan must be acceptable to the Owner prior to beginning work.

4. Submit CSPP Revisions. All revisions to the CSPP or SPCD shall be submitted by the Contractor to the Airport Operator and Engineer to coordinate FAA approval as soon as required changes are

identified and prior to implementing any changes. The revisions must be acceptable to the FAA prior to implementing any changes.

2.4 Meet CSPP Requirements.

1. Requirements for writing CSPP – Not Used

2. Safety Plan Compliance Document. The SPCD **s**hould include a statement by the Contractor that he/she has read and will abide by the CSPP. In addition, the SPCD must include all supplemental information that could not be included in the CSPP prior to contract award. The contractor statement should include the name of the contractor, the title of the project, the FAA Study (ASN) Number, approval date and a reference to any supplemental information. The supplemental information in the SPCD should be written to match the format of the CSPP indicating each subject by corresponding CSPP subject number and title. If no supplemental information is necessary "No supplemental information," should be written after the corresponding subject title. The SPCD should not duplicate information in the CSPP.

2.5 COORDINATION. Operational safety during construction will be discussed during the pre-bid and preconstruction conferences. In addition:

1. Progress Meetings. Operational safety shall be a standing agenda item for discussion during progress meetings throughout the project.

2. Scope or Schedule Changes. Changes in the scope or duration of the project may necessitate revisions to the CSPP. All changes will be reviewed and approved by the airport operator and the FAA prior to implementing any changes.

3. FAA Air Traffic Organization (ATO), Airports District Office (ADO), and NAVAID Impacts. No FAA owned airway facility shutdowns or restarts are anticipated. Coordination with FAA ATO is not required to schedule navigational aid shutdowns and restarts during construction.

The Runway 11 and 29 PAPI's and REIL's (all Sponsor owned), and the RW 11-29 MIRLS, will be shut down for the duration of the project. The "Airport Sponsor Strategic Event Submission Form" will be submitted to FAA at least 45 days prior to the start of construction. The project has been coordinated with Ryan Zulauf, Randal Anton, and Jacob Hamilton, Project Managers, Seattle ADO, and Seattle Flight Procedures. Commissioning of the new Runway 29 PAPI is currently planned for the fall of 2022.

- Runway 29 PAPI (Sponsor owned) will require shutdown as noted on the CSPP drawings
- Runway 11-29 MIRL (Sponsor owned) will required shutdown as noted on the CSPP drawings
- Runway 11 PAPI (Sponsor Owned) will require shutdown as noted on the CSPP drawings
- Runway 29 REIL (Sponsor owned) will require shutdown as noted on the CSPP drawings
- A Reimbursable Agreement for the Runway 29 PAPI and RW 29 REIL (both Sponsor owned) will be required for an FAA Flight Check at the completion of construction

2.6 PHASING. The sequence of construction has been phased to gain maximum efficiency while allowing for the required operations. The construction phases have been coordinated with airport users and have been incorporated into the project design, contract drawings, and specifications, and are reflected in this CSPP.

1. Phase Elements. For each phase, the CSPP includes:

- Areas closed to aircraft operations
- Duration of closures
- Taxi routes
- ARFF access routes - NA
- Construction staging, disposal and cleanout areas
- Construction access and haul routes
- Impacts to NAVAIDs
- Lighting marking and signing changes
- Available runway length including changes to safety areas and object free areas - NA
- Declared distances - NA
- Hazard marking, lighting and signing
- Lead times for required notifications

2. Construction Safety Drawings. Drawings indicating operational safety procedures and methods in affected areas have been developed for each construction phase. See CSPP drawings included in this document.

2.7 AREAS AND OPERATIONS AFFECTED BY CONSTRUCTION ACTIVITY. The CSPP has been developed to allow runways and taxiways to remain in use to the maximum extent possible without compromising safety. The plan was coordinated with airport users and the FAA during project design.

1. **Identification of Affected Areas.** Areas and operations affected by construction are identified in the CSPP drawings included in this document. The following items are addressed:
   - **(1)** Closing, or partial closing, of runways, taxiways and aprons, and displaced thresholds
   - **(2)** Closing of Aircraft Rescue and Firefighting access routes - NA
   - **(3)** Closing of access routes used by airport vehicles
   - **(4)** Interruption of utilities, including water supplies for firefighting
   - **(5)** Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads

2. Mitigation of Effects. Specific procedures necessary to maintain the safety and efficiency of airport operations are identified in the CSPP drawings. The following items are addressed:

- **(1)** Temporary changes to runway and/or taxi operations
- **(2)** Detours for airport vehicles
- **(3)** Maintenance of essential utilities

2.8 NAVIGATION AID (NAVAID) PROTECTION. This project has been coordinated with the FAA ATO/Technical Operations office. Impacts on NAVAIDs are:

- Runway 29 PAPI (Sponsor owned) – Relocation due to threshold relocation
- Runway 29 REIL (Sponsor owned) – Relocation due to threshold relocation
- Runway 11-29 MIRL (Sponsor owned) – reconfiguration due to threshold relocation
- Runway 11 PAPI (Sponsor owned) – shutdown required during construction
- Runway 11 REIL (Sponsor owned) – shutdown required during construction
- Surface Weather System (SWS) (FA owned) – SWS will remain operational at all times during construction. The SWS and its critical area are shown on the CSPP drawings. If work is required within the critical area, contractor shall coordinate with the Resident Project

Representative (RPR). Stockpiling material, as well as movement and parking of equipment is not allowed in NAVAID critical areas.

The Contractor shall coordinate temporary shutdown of NAVAIDs with the Engineer. NOTAMs must be filed for certain construction activities. This project is being coordinated with the Seattle ADO.

Approval of a separate Form 7460-1 for Permanent Impacts is not required. The Airport Operator will submit the required Form 7460-1 for Temporary Construction.

2.9 CONTRACTOR ACCESS. The CSPP drawings show the areas to which the contractor has access, and how contractor personnel will access those areas. Specifically addressed are:

1. Location of Stockpiled Construction Materials. Stockpiled materials and equipment storage are not permitted within the Runway Safety Area (RSA) or Object Free Area (OFA) of an operational runway. Stockpiled materials and equipment adjacent to these areas shall be prominently marked and lighted during hours of restricted visibility or darkness. This includes determining and verifying that materials are stabilized and stored at an approved location so as not to be a hazard to aircraft operations and to prevent attraction of wildlife and foreign object damage.

2. Vehicle and Pedestrian Operations. Vehicle and pedestrian access routes are shown on the CSPP drawings and are designed to prevent inadvertent or unauthorized entry of persons, vehicles, or animals onto the air operations area (AOA). These routes have been coordinated with airport tenants. The following is included:

(1) Construction Site Parking. Construction site parking for Contractor's personal vehicles shall be confined to the areas identified on the CSPP drawings. These areas provide reasonable contractor employee access to the job site.

(2) Construction Equipment Parking. Contractor employees shall park and service all construction vehicles in an area outside the OFA and never in the safety area of an active runway or taxiway. Inactive equipment shall not be parked on a closed taxiway or runway unless a complex setup procedure makes movement of specialized equipment infeasible. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be lighted.

(3) Access and Haul Roads. The contractor shall not use any access or haul roads other than those approved. Where able, access routes used by Contractor vehicles shall be clearly marked to prevent inadvertent entry to areas open to airport operations. The Engineer will have the final authority regarding marking requirements for access routes. Contractor shall not block vehicle access roads or gates at any time.

(4) Marking and Lighting of Vehicles. Contractor vehicles shall be marked and lighted in accordance with current AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport. To operate in the AOA during daylight hours, the vehicle must have a flag or amber-flashing beacon attached to it. Any vehicle operating in the AOA during hours of darkness or reduced visibility must be equipped with an amber-flashing beacon.

(5) Description of Proper Vehicle Operations on various areas under normal, lost communications, and emergency conditions:

Vehicles operating within or crossing the AOA must have prior approval from the airport Owner. If a vehicle becomes lost or has a radio failure, the operator should vacate the runway or taxiway as quickly and safely as possible and advise the Contractor's safety office or superintendent of the

situation and wait for further instruction. If an emergency condition occurs, the contractor's staff should meet at a location designated by the contractor's safety officer.

(6) Required Escorts. Vehicular traffic located in or crossing an AOA must have a working two-way radio or be escorted by a vehicle with a radio. All drivers shall confirm that no aircraft is approaching the vehicle position. Construction personnel may operate in an AOA without two-way radio communication provided a NOTAM is issued closing the area and the area is properly marked and barricaded to prevent incursions

(7) Training Requirements for Vehicle Drivers.

To ensure compliance with the airport's rules and regulations, to ensure compliance with the airport's rules and regulations, anyone operating a vehicle on the airport will be required to study the Airport's "Airport Ground Vehicle Operations" study guide and pass a quiz prior to operating a vehicle on the airport. Operators will be required to know and understand vehicle operations under normal, lost communications, and emergency conditions. The Contractor's Safety Officer will be responsible to ensure contractor's operations are in compliance with the airport's vehicle rules and regulations. The Contractor's Safety Officer and personnel will be trained on the rules and regulations by Airport Staff prior to beginning the project.

The Contractor shall ensure that all personal who will be driving vehicles thoroughly understand airport operations and the airport's vehicle rules and regulations. Emphasis shall be placed on the importance of Runway OFZ(s) and OFA(s), Taxiway OFA(s), and safety areas of taxiway(s) and runway(s), hold lines, movement area lines airfield markings, notices to airmen (NOTAMs), radio operation, and understanding this CSPP.

(8) Situational Awareness. Vehicle drivers shall confirm by personal observation that no aircraft is approaching their position (either in the air or on the ground) when crossing a runway, taxiway, or other area open to airport operations. No vehicles shall pass in front of pedestrians or moving aircraft. In addition, it is the responsibility of escort vehicle drivers to verify the movement and position of all escorted vehicles

(9) Two-Way Radio Communication Procedures.

(1) General. Construction contractor personnel engaged in activities involving unescorted operation on aircraft movement areas must observe the proper procedures for communications, including using the appropriate radio frequency. When operating vehicles on or near open runways or taxiways, construction personnel must maintain radio contact and announce their intentions at all times with:

- Airport Traffic Control Tower (ATCT) during hours of operation (6:00 AM to 8:00 PM) and with aircraft during non-ATCT time periods 8:00 PM to 6:00 AM) on the Common Traffic Advisory Frequency (CTAF) and

The contractor shall provide two radios capable of communication with the CTAF and ATCT and designate an individual to monitor aircraft operations during all construction activities. The individual operating the radio shall be trained in aviation radio communications.

(2) Areas Requiring Two-Way Radio Communication with the ATCT.

- Vehicles operating in an active movement area must have a working two-way radio in contact with the ATCT or be escorted by a vehicle in radio contact with the ATCT during its hours of operation (6:00 AM to 8:00 PM). Monitor the CTAF at other times (6:00 AM to 8:00 PM). The individual operating the radio shall be trained in aviation radio communications. Before movement, the driver shall

confirm that no aircraft is approaching the vehicle position. Construction personnel may operate in a movement area without two-way radio communication provided a NOTAM has been coordinated with the airport and ATCT, has been issued closing the area, the contractor has designated an individual to monitor aircraft operations, and the area is properly marked to prevent aircraft incursions.

(3) Frequencies to be Used. The contractor shall use and monitor the ATCT ground control frequency 121.9 MHz between the hours of 6 AM and 8 PM. When the ATCT is closed, use the CTAF 119.7 MHz.

(4) Radio Usage. Contractor shall adhere to proper radio usage protocol, including read back requirements.

(4) Phraseology. Radio operators shall use proper phraseology, including the International Phonetic Alphabet.

(6) Light gun signals. Even though radio communication is maintained, vehicle drivers must also familiarize themselves with ATCT light gun signals in the event of radio failure.

(10) Maintenance of the Secured Area of the Airport:

(1) Fencing and Gates. Contractor shall maintain security during construction including any access points created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates shall be equipped so they can be securely closed and locked to prevent access by animals and unauthorized people. Procedures shall be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit "piggybacking" behind another person or vehicle.

(2) Badging Requirements. Background checks and badging of Contractor's Personnel is not required.

(11) Flagging. Not Used

2.10 WILDLIFE MANAGEMENT. The airport has a Wildlife Hazard Management Plan. The Contractor shall carefully control and continuously remove waste or loose materials that might attract wildlife. Contractor personnel shall be aware of and avoid construction activities that can create wildlife hazards on airports, such as:

1. **Trash** Food scraps must be collected from construction personnel activity.
2. **Standing Water**
3. **Tall Grass and Seeds**
4. **Poorly Maintained Fencing and Gates** See 2.9.2(10)(1) above.
5. **Disruption of Existing Wildlife Habitat** Contractor personnel shall immediately notify the airport operator of wildlife sightings.

2.11 FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT. The Contractor shall not leave or place FOD on or near active aircraft movement areas. Materials capable of creating FOD damage shall be continuously removed during the construction project. Fencing may be necessary to contain material that can be carried by wind into areas where aircraft operate.

2.12 HAZARDOUS MATERIALS (HAZMAT) MANAGEMENT. The contractor shall be prepared to expeditiously contain and clean-up spills resulting from fuel or hydraulic fluid leaks.

2.13 NOTIFICATION OF CONSTRUCTION ACTIVITIES. The contractor shall immediately notify the airport operator or RPR of any conditions adversely affecting the operational safety of the airport.

1. List of Responsible Representatives/Points of Contact. The contractor shall prepare and maintain an emergency contact list for all involved parties, and procedures for contacting each party, including after hours.

2. NOTAMs. Before beginning any construction, activity which may impact the normal operations at the airport the contractor must ensure that the activity has been, coordinated with the RPR and airport operator, and then reported using the FAA's Notice to Airmen (NOTAM) system. Upon completion of work and return of areas to standard conditions, the contractor must verify the cancellation of all applicable NOTAMs. Only the airport operator may initiate or cancel NOTAMs, and is the only entity that can close or open a runway.

3. Emergency Notification Procedures for medical, firefighting, and police response, the Contractor shall call 911 first, then as follows:

1. During ATCT hours of operation (6 AM to 8 PM), the Contractor shall contact the ATCT. After ATCT operation hours (8 PM to 6 AM) the Contractor shall contact the Airport Manager at (541) 215-0817 and the Engineer's RPR.

2. Additional procedures for notifying emergency personnel, mutual aid providers, and other emergency services when the contractor is working on the airfield will be provided to the Contractor at the Preconstruction Conference.

4. Coordination with ARFF. Not Used

5. Notification to the FAA. All communication with the FAA will be accomplished by the airport operator.

2.14 INSPECTION REQUIREMENTS.

1. Daily Inspections. Daily inspections shall be conducted by the contractor to ensure conformance with this CSPP. A Construction Progress Daily Safety (CPDS) checklist, enclosed as part of this document, shall be used.

2. Interim Inspections. Inspections shall be conducted by the contractor of all areas to be opened to aircraft traffic to ensure the proper operation of lights and signs, for correct markings, and absence of FOD. The contractor shall conduct an inspection of the work area with airport operations personnel. The contractor shall ensure that all construction materials have been secured, all pavement surfaces have been swept clean, all transition ramps have been properly constructed, and that surfaces have been appropriately marked for aircraft to operate safely. Only once all items on the list meet the airport operator and RPR's satisfaction shall the area be opened to aircraft operations. The contractor shall retain a suitable workforce and the necessary equipment at the work area for any last minute cleanup that may be requested by the airport operator or RPR prior to opening the area.

3. Final Inspection. A final inspection with the participation of the Owner, Engineer, RPR, Contractor and any Owner invited stakeholders will be performed.

2.15 UNDERGROUND UTILITIES. Known utilities and structures expected to be encountered in the work area shown on the Construction Drawings. There may be some discrepancies and omissions in the locations and quantities of utilities and structures shown. Those shown are for the convenience of the Contractor only, and no responsibility is assumed by either the airport or the Engineer for their accuracy or completeness.

Coordination among the FAA, airport management, National Weather Service, utility companies, RPR, and contractors will be accomplished at the Preconstruction Conference. NAVAIDs, Weather Service facilities, electric cables, and other utilities must be fully protected during the entire construction time.

2.16 PENALTIES. Contractors are subject to suspension of work for noncompliance. Contractor Personnel who violate safety requirements may be removed from the project at the sole discretion of the Owner

2.17 SPECIAL CONDITIONS. None

2.18 RUNWAY AND TAXIWAY VISUAL AIDS. The contractor shall ensure that areas where aircraft will be operating are clearly and visibly separated from construction areas, including closed runways. Throughout the duration of the construction project, the contractor shall verify that these areas remain clearly marked and visible at all times and that marking, lighting, signs, and visual NAVAIDs that are to continue to perform their functions during construction remain in place and operational. Visual NAVAIDs that are not serving their intended function during construction must be temporarily disabled, covered, or modified as necessary.

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

2. Markings. Markings shall be in compliance with the current standards of AC 150/5340-1, Standards for Airport Markings. Where possible, any temporary markings on finish grade pavements shall be placed to mirror the dimensions of the final markings.

(1) Closed Runways and Taxiways. The CSPP drawings show the required marking for runway and taxiway closure.

3. Lighting and Visual NAVAIDs. Lighting must be in conformance with current AC 150/5340-30, Design and Installation Details for Airport Visual Aids, and AC 150/5345-50, Specification for Portable Runway and Taxiway Lights. When disconnecting runway and taxiway lighting fixtures, disconnect the associated isolation transformers. See current AC 150/5340-26, Maintenance of Airport Visual Aid Facilities, for disconnect procedures and safety precautions. Alternately, cover the light fixture in such a way as to prevent light leakage. Avoid removing the lamp from energized fixtures because an excessive number of isolation transformers with open secondaries may damage the regulators and/or increase the current above its normal value. Secure, identify, and place any above ground temporary wiring in conduit to prevent electrocution and fire ignition sources. Precision Approach Path Indicators (PAPIs), Visual Approach Slope Indicators (VASIs), Runway End Identifier Lights (REILs) and lighting will require altering, screening, or deactivation during the project, see CSPP drawings for additional requirements. It is the contractor's responsibility to perform the work and coordinate all such changes with the Owner or RPR to ensure proper NOTAMs are issued. At the end of each day the contractor shall perform a check of temporary electrical facilities. A log of the daily checks shall be maintained onsite.

(1) Permanently Closed Runways and Taxiways. Not Used

(2) Temporarily Closed Runways Use a lighted X, both at night and during the day, placed at each end of the runway facing the approach. The lighted X must be illuminated at all times it is on a runway. During Runway closures, PAPIs, REILs and airfield lighting shall be turned off, screened or deactivated.

(3) Partially Closed Runways. Not Used

(4) Temporary Displaced Thresholds. Not Used

(5) Temporarily Closed Taxiways. Deactivate the taxiway lighting circuits. When deactivation is not possible (for example other taxiways on the same circuit are to remain open), cover the light fixture in such a way as to prevent light leakage. Contractor shall submit method to airport operator and engineer for approval prior to construction.

4. **Signs.** Signs will be in conformance with current AC 150/5345-44, Specification for Runway and Taxiway Signs and AC 150/5340-18, Standard for Airport Sign Systems. Any time a sign does not serve its normal function; it must be covered or removed to prevent misdirecting pilots. Runway exit signs are to be covered for closed runway exits. Outbound destination signs are to be covered for closed runways. Information signs identifying a crossing taxiway continue to perform their normal function even if the crossing taxiway is closed. Maintain mandatory hold signs to operate normally in any situation where pilots or vehicle drivers could mistakenly be in that location. The CSPP drawings show the required sign screening for runway and taxiway closures.

(1) Temporary Signs. Not Used

2.19 MARKING AND SIGNS FOR ACCESS ROUTES. Pavement markings and signs will conform to current AC 150/5340-18 and with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) or State highway specifications. Signs adjacent to areas used by aircraft will comply with the frangibility requirements of current AC 150/5220-23, Frangible Connections.

2.20 HAZARD MARKING, LIGHTING AND SIGNING.

1. **Hazard Marking and Lighting**. Hazardous areas in the AOA, including any area affected by construction that is normally accessible to aircraft, personnel, or vehicles, open manholes, areas under repair, stockpiled material, waste areas, open trenches and excavations and areas subject to jet blast, shall be marked with barricades. During periods of low visibility and at night, red flashing lights shall be operational on the barricades. The hazardous area marking and lighting shall be furnished and maintained by the contractor.

2. **Equipment.**

(1) Barricades. Low profile barricades, including traffic cones, (weighted or sturdily attached to the surface) are acceptable methods to identify and define the limits of construction and hazardous areas. Careful consideration must be given to selecting 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. The spacing of barricades must be such that a breach is physically prevented barring a deliberate act. For example, if barricades are intended to exclude aircraft, gaps between barricades must be smaller than the wingspan of the smallest aircraft to be excluded; if barricades are intended to exclude vehicles, gaps between barricades must be smaller than the width of the excluded vehicles, generally 4 feet. Provision must be made for ARFF access if necessary. If barricades are intended to exclude pedestrians, they must be continuously linked. Continuous linking may be accomplished through the use of ropes, securely attached to prevent FOD

(2) Lights. Lights shall be red, either steady burning or flashing, and must meet the luminance requirements of the State Highway Department. Lights shall be mounted on barricades and spaced at no more than 10 ft. Lights shall be operated between sunset and sunrise and during periods of low visibility whenever the airport is open for operations.

(3) Signs. Not Used

(4) Air Operations Area - General. Barricades are not permitted in any active safety area or on the runway side of a runway hold line. Within a runway or taxiway object free area, and on aprons, the contractor shall use orange traffic cones, flashing or steady burning red lights as noted above, highly reflective collapsible barricades marked with diagonal, alternating orange and white stripes; and/or signs to separate all construction/maintenance areas from the movement area. Barricades may be supplemented with alternating orange and white flags at least 20 by 20 in square and securely fastened to eliminate FOD. All barricades adjacent to any open runway or taxiway safety area, or apron must be as low as possible to the ground, and no more than 18 in high, exclusive of supplementary lights and flags. Barricades shall be of low mass; easily collapsible upon contact with an 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. If affixed to the surface, they shall be frangible within 3 inches of the ground.

(5) Air Operations Area - Runway/Taxiway Intersections. The contractor shall use highly reflective "low profile" barricades with lights to close taxiways leading to closed runways.

(6) Air Operations Area - Other. Beyond runway and taxiway object free areas and aprons, the contractor may use various materials, including railroad ties, sawhorses, jersey barriers, or barrels as barricades intended for construction vehicles and personnel.

(7) Maintenance. The construction specifications include a provision requiring the contractor to have a person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. The contractor shall file the contact person's information with the airport operator. Lighting shall be checked for proper operation at least once per day, preferably at dusk.

2.21 WORK ZONE LIGHTING FOR NIGHTTIME CONSTRUCTION. Lighting equipment must adequately illuminate the work area if the construction is to be performed during nighttime hours. Refer to current AC 150/5370-10 for minimum illumination levels for nighttime paving projects. Additionally, it is recommended that all support equipment, except haul trucks, be equipped with artificial illumination to safely illuminate the area immediately surrounding their work areas. Light towers should be positioned and adjusted to aim away from the ATCT and active runways. Shielding may be necessary.

2.22 PROTECTION OF RUNWAY AND TAXIWAY SAFETY AREAS. Runway and taxiway safety areas, obstacle free zones (OFZ), object free areas (OFA), and approach/departure surfaces shall be protected at all times by the contractor. The CSPP drawings show these areas. This project is being coordinated with the Seattle ADO. Approval of a separate Form 7460-1 for construction activities is not required.

1. Runway Safety Area (RSA). A runway safety area is the defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. Construction activities within the existing RSA are subject to the following conditions:

(1) No construction may occur within the RSA while the runway is open for aircraft operations.

(2) Not Used

(3) Not Used

(4) Excavations

(1) Open trenches or excavations are not permitted within the RSA while the runway is open. If the runway must be opened before excavations are backfilled, the contractor shall cover the excavations appropriately. Covering for open excavations shall be designed to allow the safe operation of the heaviest aircraft operating on the runway without damage to the aircraft.

(2) The contractor shall prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

(5) Erosion Control. Soil erosion must be controlled to maintain RSA standards, that is, the RSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and be capable, under dry conditions, of supporting airport operations equipment and the occasional passage of aircraft without causing structural damage to the aircraft.

(2) Runway Object Free Area (ROFA). Construction, including excavation, is not permitted in the ROFA. Equipment and material shall not be stored or stockpiled in the ROFA.

(3) Taxiway Safety Area (TSA). A taxiway safety area is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. Construction activities within the TSA are subject to the following conditions:

(1) No construction may occur within the TSA while the taxiway is open for aircraft operations.

(2) Not Used

(3) Not Used

(4) Excavations.

(1) Curves. Open trenches or excavations are not permitted within the TSA while the taxiway is open. If the taxiway must be opened before excavations are backfilled, the contractor shall cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the taxiway without damage to the aircraft.

(2) Straight Sections. Open trenches or excavations are not permitted within the TSA while the taxiway is open. If the taxiway must be opened before excavations are backfilled, the contractor shall cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the taxiway without damage to the aircraft.

(3) The contractor shall prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

(5) Erosion Control. Soil erosion must be controlled to maintain TSA standards, that is, the TSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and be capable, under dry conditions, of supporting airport operations equipment and the occasional passage of aircraft without causing structural damage to the aircraft.

4. Taxiway Object Free Area (TOFA). Unlike the Runway Object Free Area, aircraft wings regularly penetrate the taxiway object free area during normal operations. The restrictions are more

stringent. No construction may occur within the taxiway object free area while the taxiway is open for aircraft operations.

5. Obstacle Free Zone (OFZ). Personnel, material, or equipment may not penetrate the OFZ while the runway is open for aircraft operations.

6. Runway Approach/Departure Areas and Clearways. Personnel, materials, and equipment shall remain clear of the applicable approach and departure surfaces.

(1) Construction activity in a runway approach/departure area. Runways will be closed when work is to be accomplished in these areas.

(2) Caution regarding partial runway closures. Not Used

(3) Caution regarding displaced thresholds. Not Used

2.23 OTHER LIMITATIONS ON CONSTRUCTION:

1. Prohibitions.

(1) The use of tall equipment is prohibited unless a Form 7460-1 determination letter has been issued by FAA. The Contractor shall submit a Form 7460-1 for the use of temporary tall equipment.

(2) Open flame welding or torches are not permitted unless fire safety precautions are provided and the airport operator has approved their use.

(3) The use of electrical blasting caps on the airport is prohibited.

(4) The use of flare pots within the AOA is prohibited.

2. Restrictions.

(1) Construction suspension required during specific airport operations. The airport owner shall have the authority to suspend the work wholly, or in part, for such period as necessary, due to conditions considered unfavorable for the prosecution of the work, or due to the failure of the Contractor to carry out orders given or perform provisions of the contract.

(2) Areas that cannot be worked on simultaneously. The contractor shall refer to the CSPP Drawings for a description of areas that cannot be worked on simultaneously.

(3) Day or night construction restrictions. The contractor shall refer to the CSPP drawings for a description of day or night construction restrictions.

(4) Seasonal construction restrictions. Not Used

3. Temporary signs not approved by the airport operator. Not Used

4. Grade changes that could result in unplanned effects on NAVAIDs. Not Used

Appendices:

Appendix A: Construction Project Daily Safety (CPDS)

Appendix B: International Phonetic Alphabet

Appendix C: Construction Safety and Phasing Plan (CSPP) Drawings

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Appendix A

Construction Project Daily Safety (CPDS)

APPENDIX A
CONSTRUCTION PROJECT DAILY SAFETY (CPDS) 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.

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 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, and 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		

Item	Action Required (Describe)	No Action Required (Check)
a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.		
Wildlife attractants - such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water - on or near airports.		
Obliterated or faded temporary markings on active operational areas.		
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.		
Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.		
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway / taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services; and/or loss of communications.		
Restrictions on 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).		
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 B

International Phonetic Alphabet

APPENDIX B
INTERNATIONAL PHONETIC ALPHABET

Letter	Word	Pronunciation
A	Alfa (ICAO, ITU, FAA) Alpha (ANSI)	**AL** FAH
B	Bravo	**BRAH** VOH
C	Charlie	**CHAR** LEE or **SHAR** LEE (ICAO, ITU)
D	Delta	**DELL** TAH
E	Echo	**ECK** OH
F	Foxtrot	**FOKS** TROT
G	Golf	GOLF
H	Hotel	HO **TELL** (ICAO) HOH **TELL** (ITU, FAA)
I	India	**IN** DEE AH
J	Juliett (ICAO, ITU, FAA) Juliet (ANSI)	**JEW** LEE **ETT**
K	Kilo	**KEY** LOH
L	Lima	**LEE** MAH
M	Mike	MIKE
N	November	NO **VEM** BER
O	Oscar	**OSS** CAH
P	Papa	PAH **PAH**
Q	Quebec	KEH **BECK**
R	Romeo	**ROW** ME OH

S	Sierra	SEE **AIR** RAH (ICAO, ITU) SEE **AIR** AH (FAA)
T	Tango	**TANG** GO
U	Uniform	**YOU** NEE FORM or **OO** NEE FORM (ICAO, ITU)
V	Victor	**VIK** TAH
W	Whiskey	**WISS** KEY
X	X-ray	**ECKS RAY** (ICAO, ITU) **ECKS** RAY (FAA)
Y	Yankee	**YANG** KEY
Z	Zulu	**ZOO** LOO
0	Zero (ICAO, FAA) Nadazero (ITU)	ZE RO (ICAO, FAA) NAH-DAH-ZAY-ROH (ITU)
1	One (ICAO, FAA) Unaone (ITU)	WUN (ICAO, FAA) OO-NAH-WUN (ITU)
2	Two (ICAO, FAA) Bissotwo (ITU)	TOO (ICAO, FAA) BEES-SOH-TOO (ITU)
3	Three (ICAO, FAA) Terrathree (ITU)	TREE (ICAO, FAA) TAY-RAH-TREE (ITU)
4	Four (ICAO, FAA) Kartefour (ITU)	**FOW** ER (ICAO, FAA) KAR-TAY-FOWER (ITU)
5	Five (ICAO, FAA) Pantafive (ITU)	FIFE (ICAO, FAA) PAN-TAH-FIVE (ITU)
6	Six (ICAO, FAA) Soxisix (ITU)	SIX (ICAO, FAA) SOK-SEE-SIX (ITU)
7	Seven (ICAO, FAA) Setteseven (ITU)	**SEV** EN (ICAO, FAA) SAY-TAY-SEVEN (ITU)
8	Eight (ICAO, FAA) Oktoeight (ITU)	AIT (ICAO, FAA) OK-TOH-AIT (ITU)
9	Nine (ICAO, FAA) Novenine (ITU)	**NIN** ER (ICAO, FAA) NO-VAY-NINER (ITU)

Appendix C

Construction Safety and Phase Plan (CSPP) Drawings

CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES

1. EXCEPT FOR CLOSURES NOTED, AIRPORT AND AIR OPERATIONS AREAS (AOAS) TO REMAIN OPEN TO AIRCRAFT OPERATIONS DURING ENTIRE COURSE OF WORK. SEE SPECIFICATIONS AND CONSTRUCTION SAFETY AND PHASING PLAN (CSPP) TEXT FOR ADDITIONAL REQUIREMENTS. CONTRACTOR SHALL COORDINATE WORK TO ASSURE MINIMUM INCONVENIENCE TO AIRPORT OPERATIONS. IN ALL CIRCUMSTANCES SAFETY SHALL TAKE PRECEDENCE.
2. AIRCRAFT ACCESS TO THE MAIN APRON AND TERMINAL AREAS TO BE MAINTAINED AT ALL TIMES DURING PHASES 1 AND 2.
3. WORK WITHIN THE RUNWAY OBSTACLE FREE AREA (ROFA) RUNWAY SAFETY AREA (RSA), TAXIWAY OBJECT FREE AREA (TOFA) OR TAXIWAY SAFETY AREA (TSA) WILL REQUIRE CLOSURE OF IMPACTED RUNWAY OR TAXIWAY. SEE AIRFIELD CRITICAL AREAS DRAWING FOR LIMITS. SEE CSPP TEXT FOR ADDITIONAL REQUIREMENTS.
4. THE CONTRACTOR SHALL PROVIDE SUFFICIENT LEAD TIME FOR REQUIRED NOTIFICATIONS WITH PROJECT STAKEHOLDERS. THIS WILL REQUIRE SUBMITTAL OF A PRELIMINARY SCHEDULE TO INCLUDE START DATES FOR INDIVIDUAL PHASES AND DATES FOR AIRPORT FACILITIES IMPACTS WITHIN 15 CALENDAR DAYS AFTER EXECUTION OF THE CONSTRUCTION CONTRACT. A REVISED "CONSTRUCTION SCHEDULE" WILL BE PREPARED IN CONJUNCTION WITH THE PRE-CONSTRUCTION MEETING. THE CONTRACTOR SHALL NOTIFY THE OWNER WITH REQUESTS FOR NOTICES TO AIRMEN (NOTAMS) 48 HOURS PRIOR TO IMPLEMENTATION. CONTRACTOR SHALL COORDINATE WITH ENGINEER FOR CONSTRUCTION RELATED AOA CLOSURES. ALL CLOSURES ARE SUBJECT TO APPROVAL BY THE OWNER. SEE CSPP TEXT FOR ADDITIONAL REQUIREMENTS.
5. CONTRACTOR SHALL DELINEATE LOCATION OF ROFA AND TOFA AT TRAFFIC ACCESS POINTS, AND PROVIDE OTHER FIELD DELINEATION TO SEPARATE CONSTRUCTION ACTIVITIES FROM AIRPORT OPERATIONS AS DIRECTED BY THE ENGINEER. DELINEATION WITHIN THE ROFA AND TOFA SHALL BE LOW PROFILE AND SHALL NOT PRESENT A HAZARD TO AIRCRAFT. CONES, STAKES, OR OTHER METHODS AS APPROVED BY THE ENGINEER MAY BE USED OUTSIDE THE ROFA AND TOFA.
6. BARRICADES, LIGHTS, AND OTHER CONSTRUCTION CONTROL DEVICES FURNISHED, PLACED, AND MAINTAINED BY THE CONTRACTOR SHALL BE PROVIDED AT VARIOUS LOCATIONS, AS NECESSARY TO ADEQUATELY SEPARATE CONSTRUCTION ACTIVITIES FROM THE AOA. BARRICADES TO BE PLACED OUTSIDE THE TSA FOR OPEN TAXIWAYS OR TAXILANES. MAY REQUIRE ADJUSTMENT DURING CONSTRUCTION ACTIVITIES. BARRICADES SHOWN ON THE DRAWINGS ARE FOR REFERENCE AND THE NUMBER AND LOCATION OF BARRICADES MAY CHANGE TO MEET SAFETY REQUIREMENTS. SEE CSPP TEXT FOR ADDITIONAL REQUIREMENTS.
7. PRIOR TO REOPENING A CLOSED RUNWAY, TAXIWAY, OR OTHER WORK AREA FOR AIRCRAFT OPERATIONS, THE CONTRACTOR SHALL PROVIDE ADEQUATE TIME FOR THE ENGINEER OR OWNER TO INSPECT FOR CLEANLINESS AND CONFORMANCE TO REGULATIONS INCLUDING GRADING REQUIREMENTS OF THE RSA AND TSA. THE TIME NEEDED FOR INSPECTION AND POSSIBLE NECESSARY CORRECTIVE ACTION SHALL BE INCLUDED WITHIN THE ALLOWED CLOSURE PERIOD.
8. WORK AREAS SHOWN IN PHASING PLANS ARE APPROXIMATE. SEE APPROPRIATE DRAWINGS FOR SPECIFIC WORK LIMITS. CONTRACTOR SHALL COORDINATE ALL WORK ELEMENTS COMPATIBLE WITH INTENDED PHASE UNLESS OTHERWISE APPROVED BY THE ENGINEER OR OWNER. AIRCRAFT OPERATIONS ROUTES SHOWN ARE APPROXIMATE AND ARE NOT LIMITED TO LOCATIONS SHOWN (OPERATIONS WILL OCCUR IN HANGAR AND RAMP AREAS AND ARE NOT SHOWN). CONTRACTOR SHALL REMAIN CLEAR OF AIRCRAFT OPERATIONS AT ALL TIMES.
9. CONTRACTOR SHALL NOT BLOCK VEHICLE ACCESS ROADS OR GATES AT ANY TIME. AT NO POINT SHALL THE CONTRACTOR LOCK OPEN ANY AUTOMATED GATES DURING CONSTRUCTION.
10. RUNWAY EDGE LIGHTING, TAXIWAY EDGE LIGHTING, AIRFIELD SIGNAGE, NAVAIDS, AND ASOS TO BE OPERATIONAL AT ALL TIMES FOR AREAS OPEN TO AIRCRAFT OPERATIONS. IT IS ANTICIPATED THAT THIS WILL REQUIRE OBSCUREMENT OF EXISTING EDGE LIGHTS AND SIGNAGE AND/OR MODIFICATIONS TO THE EXISTING AIRFIELD ELECTRICAL CIRCUITS. AIRFIELD SIGN(S) TO BE SCREENED BY THE CONTRACTOR USING A METHOD APPROVED BY THE ENGINEER. MAY REQUIRE ADJUSTMENT DURING CONSTRUCTION ACTIVITIES. CONTRACTOR TO SUBMIT TEMPORARY AIRFIELD LIGHTING, SIGNAGE, AND ELECTRICAL PLAN TO THE RPR FOR APPROVAL PRIOR TO BEGINNING WORK. ONCE PERMANENT SIGNAGE IS INSTALLED, IT SHALL BE SCREENED TO INDICATE ONLY THE ACTIVE AREAS DURING THAT PHASE.
11. LOCATION OF THE CONTRACTOR'S STAGING AREAS ARE APPROXIMATE. VERIFY LIMITS AND LOCATIONS WITH ENGINEER PRIOR TO MOBILIZATION.
12. ALL VEHICLES NOT ESSENTIAL FOR CONSTRUCTION, INCLUDING CONTRACTOR-EMPLOYEE VEHICLES SHALL REMAIN OUTSIDE OF AIR OPERATIONS AREA. PARKING SHALL BE CONFINED TO A LOCATION DESIGNATED BY THE OWNER OUTSIDE THE AIRFIELD SECURITY FENCE. ALL EQUIPMENT AND VEHICLE OPERATORS SHALL HAVE AIRFIELD DRIVER TRAINING BEFORE ACCESSING THE AOA.
13. CONTRACTOR IS RESPONSIBLE FOR ALL SAFETY MEASURES THAT MAY BE REQUIRED BY THE CONTRACTOR'S MEANS AND METHODS OF CONSTRUCTION AS NEEDED TO PROVIDE A SAFE ENVIRONMENT FOR AIRCRAFT OPERATIONS AND TO COMPLY WITH THE PROJECT CONSTRUCTION SAFETY AND PHASING PLAN.
14. THE CONTRACTOR SHALL USE AND MONITOR THE AIRPORT'S VHF FREQUENCIES; 119.7 MHZ (TOWER – 0600-2000 LOCAL TIME, COMMON TRAFFIC ADVISORY FREQUENCY (CTAF) AT OTHER TIMES) AND 121.900 MHZ (GROUND – 0600-2000 LOCAL TIME). SEE CSPP TEXT FOR ADDITIONAL REQUIREMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN FROM THE ENGINEER OR OWNER, TRAINING ON THE APPROPRIATE OPERATIONS AND PROTOCOL FOR BROADCASTING ON THE AIRPORT FREQUENCY.
15. ALL CONTRACTOR AND SUBCONTRACTOR PERSONNEL WORKING ON THE PROJECT WILL BE REQUIRED TO ATTEND AIRPORT OPERATIONS TRAINING PRIOR TO STARTING ON-SITE CONSTRUCTION ACTIVITIES. AIRPORT ADMINISTRATION WILL CONDUCT TRAINING.
16. AIRPORT WILL ISSUE GATE ACCESS CARDS/CODES TO CONTRACTOR TO ALLOW AUTOMATED VEHICLE GATE ACCESS. CONTRACTOR WILL BE CHARGED REPLACEMENT COSTS FOR ANY CARDS NOT RETURNED UPON COMPLETION OF THE PROJECT.
17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF PERSONS AND PROPERTY FROM AIRCRAFT BLAST WHEN WORKING AROUND OR NEAR AIRCRAFT ACTIVITIES.
18. THE CONTRACTOR SHALL MAKE AVAILABLE AT ALL TIMES A VACUUM SWEEPER TRUCK, FOD BOSS, OR OTHER ENGINEER APPROVED EQUIPMENT AS REQUIRED TO KEEP ALL ON-AIRPORT CONSTRUCTION ROUTES CLEAN AND FREE OF FOD. IT IS ANTICIPATED THAT CONTINUOUS MONITORING OF SURFACES WITHIN AND ADJACENT TO THE WORK AREAS WILL BE REQUIRED AT ALL TIMES DURING CONSTRUCTION.
19. ALL PORTIONS OF WORK NOT COVERED BY PAYMENT UNDER A SPECIFIC BID ITEM OR LISTED AS INCIDENTAL TO A BID ITEM SHALL BE CONSIDERED INCIDENTAL TO THE MOBILIZATION BID ITEM.
20. IF THE CONTRACTOR FAILS TO COMPLETE ANY OF THE PHASES OR RUNWAY OPENINGS WITHIN THE SPECIFIED TIME PERIOD, LIQUIDATED DAMAGES WILL BE ASSESSED. SEE SPECIFICATIONS.
21. PERSONNEL AND VEHICLES LOCATED IN OR CROSSING ACTIVE AOA (INCLUDING ROFZ, RSA, AND TOFA) MUST HAVE A WORKING TWO-WAY RADIO, OR BE ESCORTED BY A VEHICLE WITH A RADIO CAPABLE OF OPERATING ON AVIATION FREQUENCIES. TWO WAY COMMUNICATION WITH AIR TRAFFIC CONTROL TOWER (ATCT) IS REQUIRED DURING THE HOURS OF ATCT OPERATION. CONTRACTOR SHALL PLACE TEMPORARY STOP SIGNS AS APPROVED BY THE ENGINEER WHEN ACCESS ROUTE IS IN USE. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. CONSTRUCTION TRAFFIC SHALL YIELD RIGHT-OF-WAY TO AIRCRAFT AT ALL TIMES.
22. CONTRACTOR, SUBCONTRACTORS, AND ALL PERSONNEL SHALL CONTACT ATCT DURING HOURS OF ATCT OPERATION TO CROSS ACTIVE AREAS. SEE PHASING PLAN SHEETS FOR ACTIVE AREAS AND CROSSING LOCATIONS.

AIRPORT RADIO FREQUENCY LIST

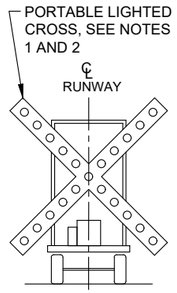
CTAF: 119.700 MHZ (24 HR)

ATCT: 119.700 MHZ (0600-2000)

GROUND: 121.900 MHZ (0600-2000)

PHASING NOTES

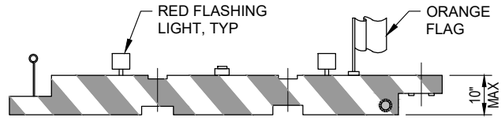
1. ANY WORK WITHIN THE ROFA OF RUNWAY 8-26 SHALL BE COMPLETED DURING HOURS OF ATCT OPERATION. ALL WORK WITHIN THIS AREA SHALL BE COORDINATED WITH THE RPR, ATCT AND THE AIRPORT.
2. CONSTRUCTION TRAFFIC SHALL NOT CROSS RUNWAY 8-26 UNLESS RUNWAY 8-26 IS CLOSED AND ALLOWED BY ATCT.
3. PHASE 3 WORK SHALL ONLY BE COMPLETED DURING HOURS OF ATCT OPERATION AND SHALL ONLY OCCUR UNDER RADIO CONTROL WITH ATCT. COORDINATION ON RADIO-CONTROL WITH THE AIRPORT, THE ENGINEER AND ATCT SHALL OCCUR NO LESS THAN 3 WEEKS IN ADVANCE OF PHASE 3 WORK.



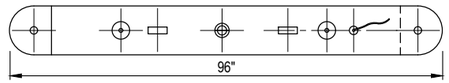
NOTES:

1. TWO PORTABLE TRAILER MOUNTED, LIGHTED CLOSURE CROSSES WILL BE PROVIDED BY THE OWNER WHEN CLOSURE OF RUNWAY 11-29 IS REQUIRED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PLACEMENT, FUELING, SERVICING AND MAINTAINING THE CONDITION OF THE CROSSES UNTIL THEY ARE RETURNED TO THE OWNER UPON COMPLETION OF THE PROJECT. ANY DAMAGE, OR REQUIRED REPAIRS, OCCURRING, OR REQUIRED WHILE THE CROSSES ARE UNDER THE RESPONSIBILITY OF THE CONTRACTOR SHALL BE REPAIRED TO THE SATISFACTION OF THE OWNER. PRIOR TO RETURNING THE CROSSES TO THE OWNER, THE CONTRACTOR SHALL PERFORM MAINTENANCE SERVICE TO THE MOTOR AND GENERATOR AND PROVIDE ANY NECESSARY REPAIRS. CONTRACTOR SHALL VERIFY CONDITION WITH ENGINEER AND OWNER PRIOR TO CONSTRUCTION. PLACEMENT AND PROTECTION IS THE SAME AS REFERENCED IN NOTE 3, BELOW. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
2. CONTRACTOR TO PLACE CLOSURE CROSSES AT THE RUNWAY NUMERALS, OR AS INDICATED ON THE DRAWINGS, ANYTIME RUNWAY 11-29 IS CLOSED TO OPERATIONS. CONTRACTOR SHALL PROVIDE NEW FABRIC CROSSES FOR USE IN THE EVENT THE LIGHTED CLOSURE CROSSES FAIL. THE ENGINEER WILL DESIGNATE ALTERNATE LOCATIONS FOR PLACEMENT OF THE CROSSES WHEN PLACEMENT OVER THE NUMERALS CONFLICTS WITH CONSTRUCTION ACTIVITIES.

RUNWAY CLOSURE CROSS DETAIL — 1 of 6
NTS



SIDE VIEW



TOP VIEW

NOTES:

1. PROVIDE BARRICADE CAPABLE OF BEING FILLED WITH WATER OR SAND. IF ALTERNATE METHOD OF ANCHORING IS USED IT SHALL NOT CAUSE DAMAGE TO PAVEMENT.
2. BARRICADE TO BE CAPABLE OF BEING DEPLOYED BY ONE PERSON WHEN EMPTY.
3. CONTRACTOR SHALL MAINTAIN ALL LIGHTS IN WORKING ORDER FOR THE DURATION OF THE PROJECT. CONTRACTOR SHALL REPLACE FLAGS AS NECESSARY OR AS DIRECTED BY THE ENGINEER DUE TO DETERIORATION.
4. BARRICADES TO BE PROVIDED BY THE CONTRACTOR ARE INCIDENTAL TO THE MOBILIZATION BID ITEM AND ARE THE PROPERTY OF THE CONTRACTOR UPON COMPLETION OF THE PROJECT.
5. NO CONSTRUCTION SHALL BEGIN UNTIL BARRICADES HAVE BEEN PLACED AND APPROVED BY THE RPR.

PORTABLE PLASTIC BARRICADE DETAIL — 2 of 6
NTS

PROJECT CONTACT LIST

ENGINEER	(541) 754-0043	(NORMAL BUSINESS HOURS)
CITY OF PENDLETON ENGINEER	(541) 966-0243	(NORMAL BUSINESS HOURS)
CITY OF PENDLETON PUBLIC WORKS	(541) 966-0201	(NORMAL BUSINESS HOURS)

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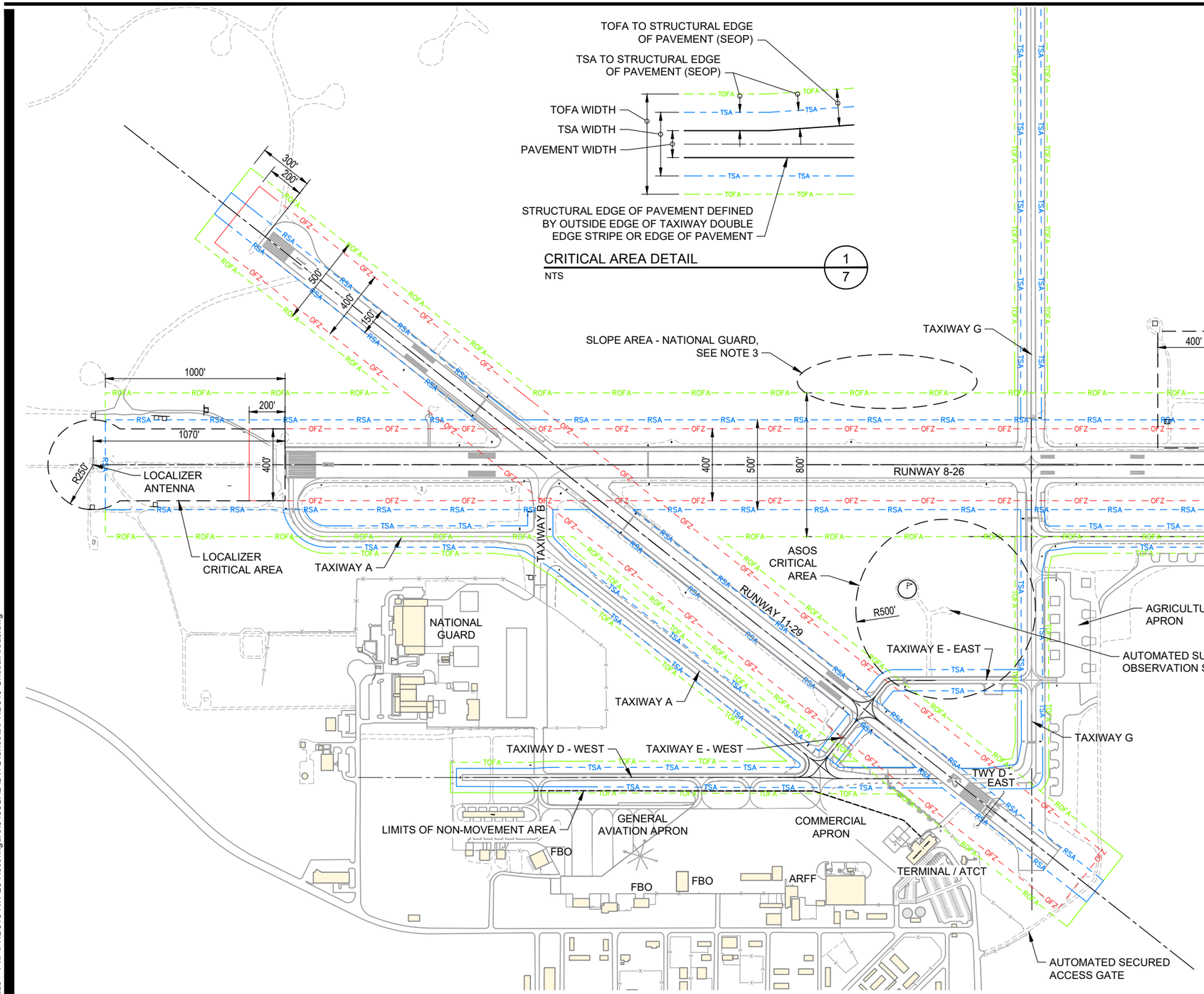
REGISTERED PROFESSIONAL ENGINEER
76512PE
DIGITALLY SIGNED
OREGON
MAY 21, 2014
TRACY L. MAY
EXPIRES: 12/31/2022

REVISIONS: DATE APPD.

DATE: MAR 2022
DESIGN: KJK
DRAWN: JAW
CHECKED: TLM
REVISION NUMBER: 0
SCALE: AS SHOWN

EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION
CONSTRUCTION SAFETY AND PHASING PLAN NOTES
PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**
SHEET NO. **6** OF **102**



NOTES

1. ACRONYMS:
   - OFZ OBJECT FREE ZONE
   - RSA RUNWAY SAFETY AREA
   - ROFA RUNWAY OBJECT FREE AREA
   - TSA TAXIWAY SAFETY AREA
   - TOFA TAXIWAY OBJECT FREE AREA
   - SEOP STRUCTURAL EDGE OF PAVEMENT
   - ATCT AIR TRAFFIC CONTROL TOWER
2. SEE CRITICAL AREA DETAIL 1/7 FOR DEFINITION OF WIDTHS.
3. APPROXIMATE LIMITS SHOWN, CONFIRM WITH ENGINEER PRIOR TO CONSTRUCTION. CONTRACTOR TO REMAIN CLEAR AT ALL TIMES.

CRITICAL AREA DIMENSIONS TABLE

AREA	PAVEMENT WIDTH	SAFETY AREA WIDTH	SAFETY AREA TO SEOP	OBJECT FREE AREA WIDTH	OBJECT FREE AREA TO SEOP
RUNWAYS					
7-25	150'	500'	175'	800'	325'
11-29	100'	150'	25'	500'	200'
TAXIWAYS					
A,B,C,D,F,G	50'	118'	34'	186'	68'
EXISTING E	40'	118'	39'	186'	73'
NEW E	50'	118'	39'	186'	73'

PRINT IN COLOR

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EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

CONSTRUCTION SAFETY AND PHASING PLAN - CRITICAL

PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**

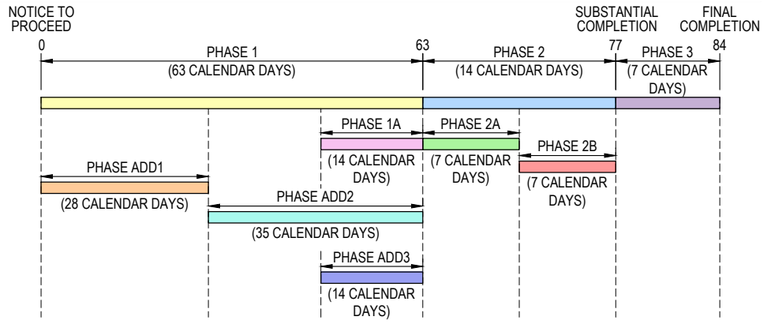
SHEET NO. **7** OF **102**

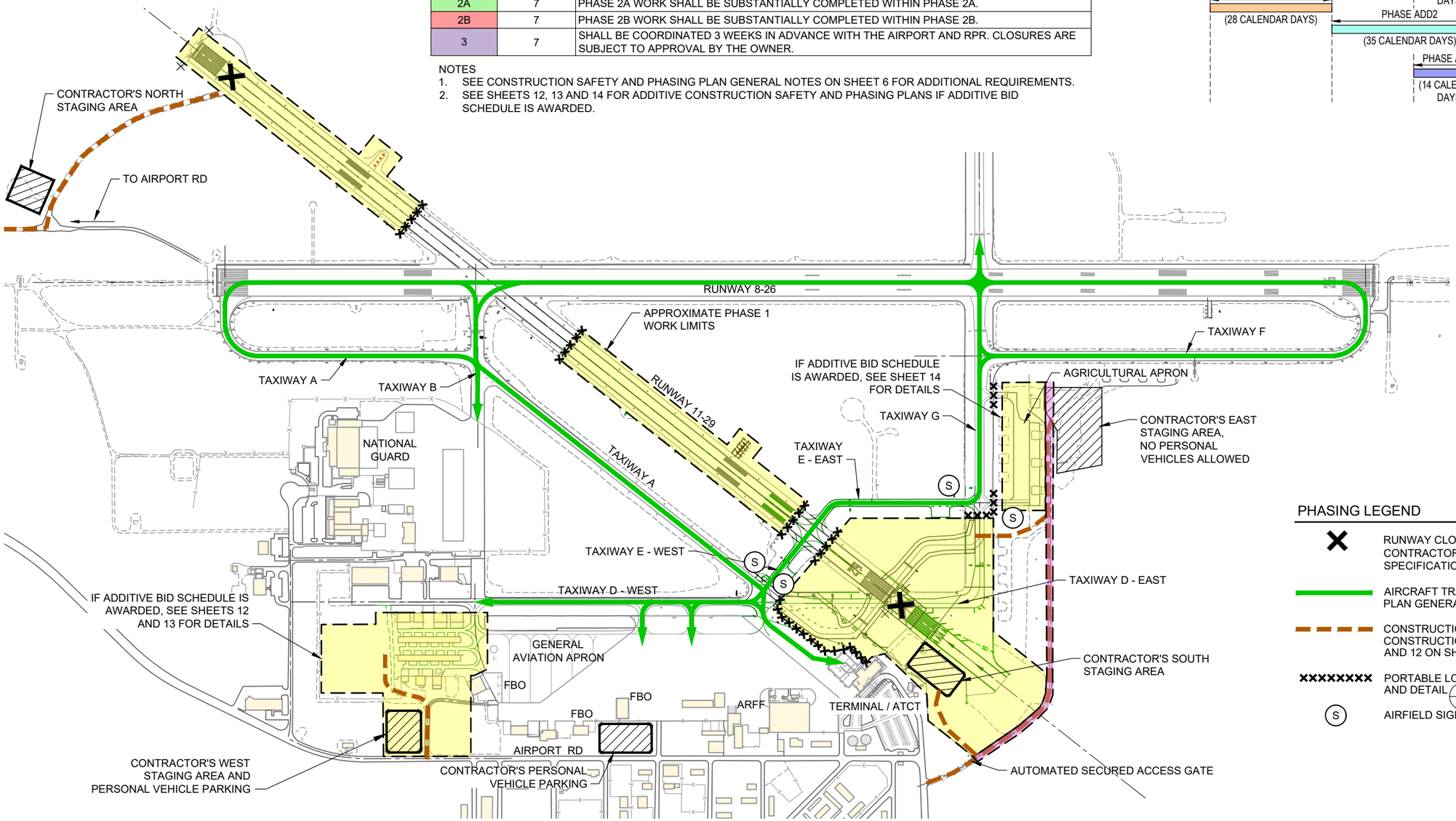
PROJECT CONSTRUCTION SCHEDULE NOTES

PHASE	CALENDAR DAYS	NOTES
1	63	AT THE COMPLETION OF PHASE 1, NEW TAXIWAYS A AND E SHALL BE CONSTRUCTED AND READY FOR USE. IF AWARDED, AT THE COMPLETION OF PHASE 1, PHASES ADD1, ADD2 AND ADD3 SHALL BE COMPLETED AND ALL ADDITIVE WORK SHALL BE CONSIDERED SUBSTANTIALLY COMPLETE
1A	14	ALL WORK REGARDING THE NEW UAS ACCESS ROAD, TO BE COMPLETED DURING THIS PHASE.
2	14	AT THE COMPLETION OF PHASE 2, RUNWAY 11-29 SHALL BE OPERATIONAL.
2A	7	PHASE 2A WORK SHALL BE SUBSTANTIALLY COMPLETED WITHIN PHASE 2A.
2B	7	PHASE 2B WORK SHALL BE SUBSTANTIALLY COMPLETED WITHIN PHASE 2B.
3	7	SHALL BE COORDINATED 3 WEEKS IN ADVANCE WITH THE AIRPORT AND RPR. CLOSURES ARE SUBJECT TO APPROVAL BY THE OWNER.

NOTES
1. SEE CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES ON SHEET 6 FOR ADDITIONAL REQUIREMENTS.
2. SEE SHEETS 12, 13 AND 14 FOR ADDITIVE CONSTRUCTION SAFETY AND PHASING PLANS IF ADDITIVE BID SCHEDULE IS AWARDED.

PROJECT CONSTRUCTION SCHEDULE





NORTH

0 150 300 600

SCALE IN FEET

PHASE 1 WORK ELEMENTS

- PAVEMENT MARKING
- ELECTRICAL IMPROVEMENTS
- DEMOLITION
- EXCAVATION
- PAVEMENT CONSTRUCTION
- DRAINAGE IMPROVEMENTS
- SURFACE GRADING
- HYDROSEEDING
- FENCE INSTALLATION
- SIGN INSTALLATION
- ADDITIVE WORK

PHASING LEGEND

- RUNWAY CLOSURE CROSS TO BE DEPLOYED AND MAINTAINED BY CONTRACTOR DURING PERIODS OF RUNWAY CLOSURE. SEE SPECIFICATIONS, AND DETAIL 1/6
- AIRCRAFT TRAFFIC, SEE CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES
- CONSTRUCTION TRAFFIC, SEE PHASING NOTE 2 AND CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES 9 AND 12 ON SHEET 6
- PORTABLE LOW PROFILE BARRICADES, SEE NOTE 6 ON SHEET 6 AND DETAIL 2/6
- (S) AIRFIELD SIGN TO BE SCREENED, SEE NOTE 10 ON SHEET 6

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EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

CONSTRUCTION SAFETY AND PHASING PLAN - PHASE 1 AND 1A

PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**

SHEET NO. **8** OF **99**

PROJECT CONSTRUCTION SCHEDULE NOTES

PHASE	CALENDAR DAYS	NOTES
1	63	AT THE COMPLETION OF PHASE 1, NEW TAXIWAYS A AND E SHALL BE CONSTRUCTED AND READY FOR USE. IF AWARDED, AT THE COMPLETION OF PHASE 1, PHASES ADD1, ADD2 AND ADD3 SHALL BE COMPLETED AND ALL ADDITIVE WORK SHALL BE CONSIDERED SUBSTANTIALLY COMPLETE
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NOTES
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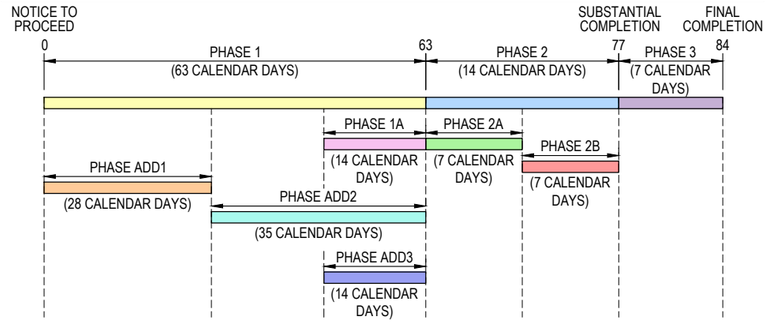
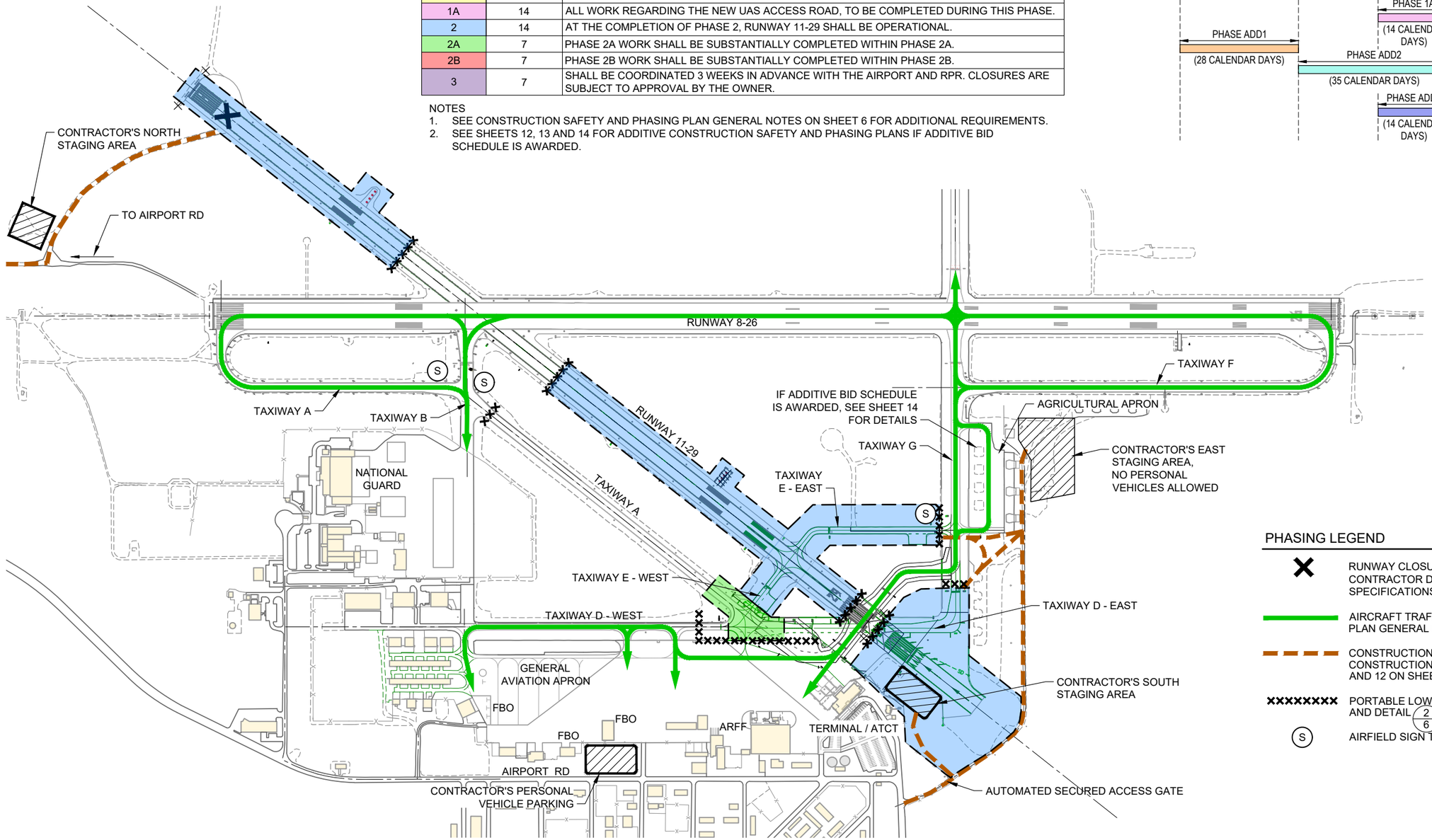
2. SEE SHEETS 12, 13 AND 14 FOR ADDITIVE CONSTRUCTION SAFETY AND PHASING PLANS IF ADDITIVE BID SCHEDULE IS AWARDED.

PROJECT CONSTRUCTION SCHEDULE





PHASE 2A WORK ELEMENTS

- PAVEMENT MARKING
- ELECTRICAL IMPROVEMENTS
- DEMOLITION
- EXCAVATION
- DRAINAGE IMPROVEMENTS
- SURFACE GRADING
- HYDROSEEDING

PHASING LEGEND

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EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

CONSTRUCTION SAFETY AND PHASING PLAN - PHASE 2 AND 2A

PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**

SHEET NO. **9** OF **102**

PROJECT CONSTRUCTION SCHEDULE NOTES

PHASE	CALENDAR DAYS	NOTES
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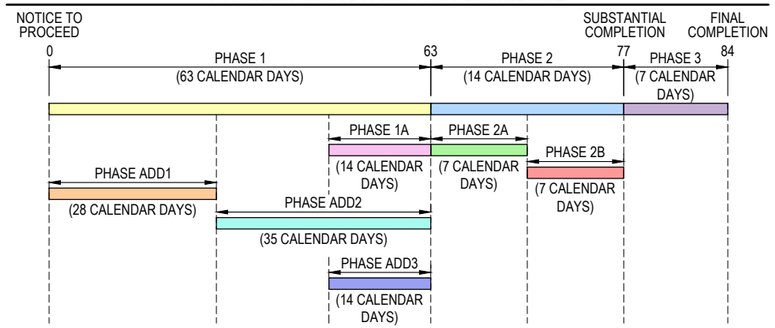
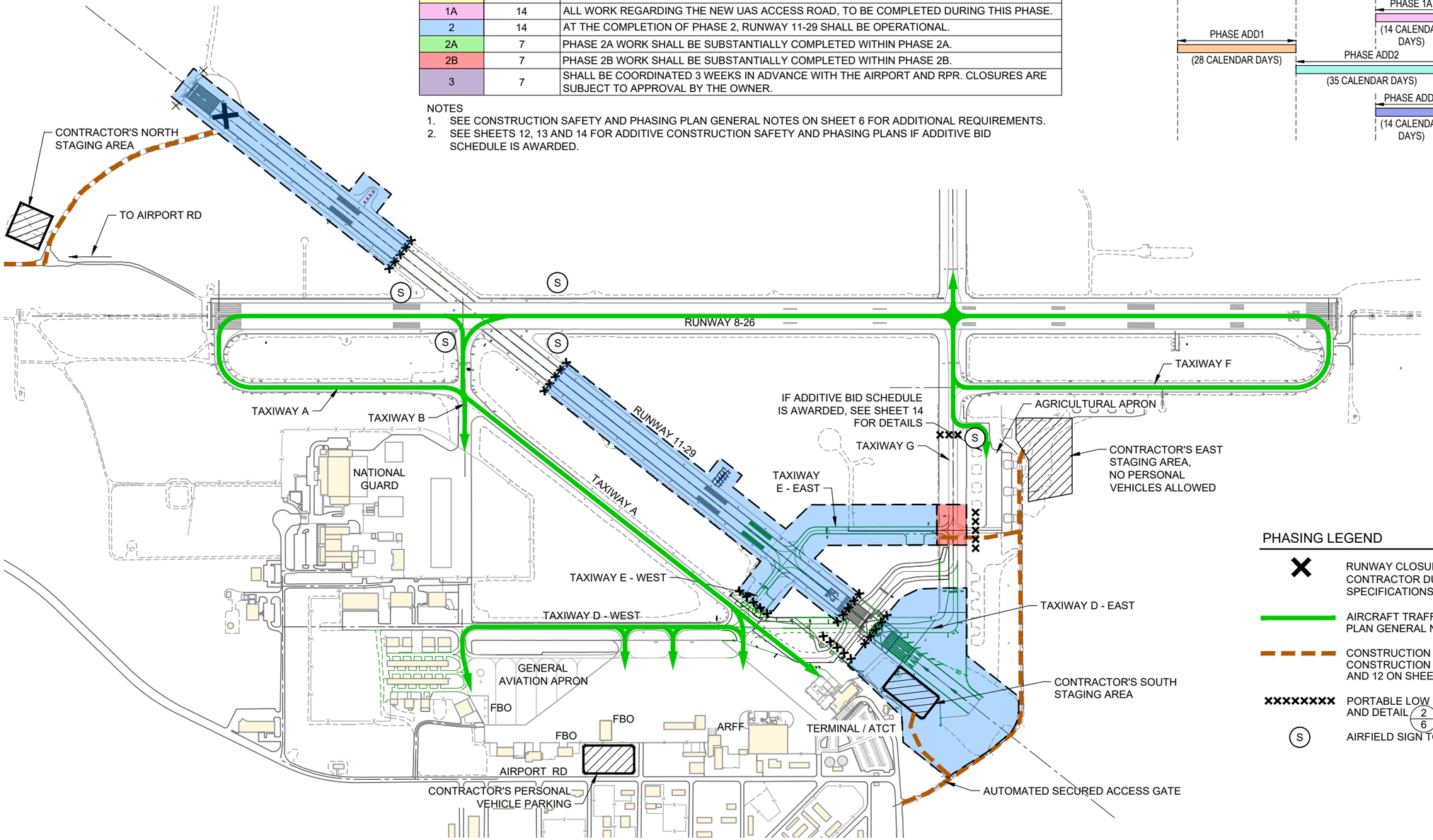
PROJECT CONSTRUCTION SCHEDULE





PHASE 2B WORK ELEMENTS

- PAVEMENT MARKING
- ELECTRICAL IMPROVEMENTS
- DEMOLITION
- EXCAVATION
- DRAINAGE IMPROVEMENTS
- SURFACE GRADING
- HYDROSEEDING

PHASING LEGEND

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EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

CONSTRUCTION SAFETY AND PHASING PLAN - PHASE 2 AND 2B

PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**

SHEET NO. **10** OF **102**

PROJECT CONSTRUCTION SCHEDULE NOTES

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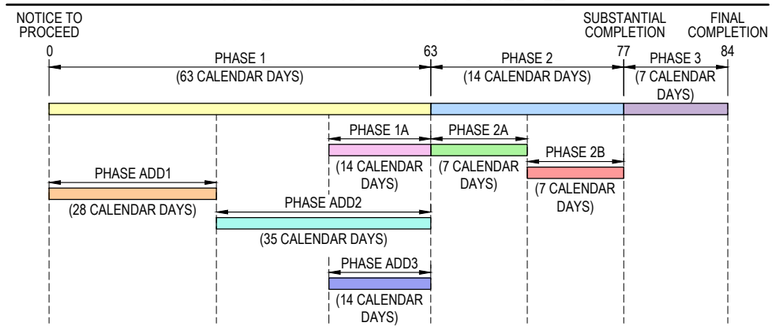
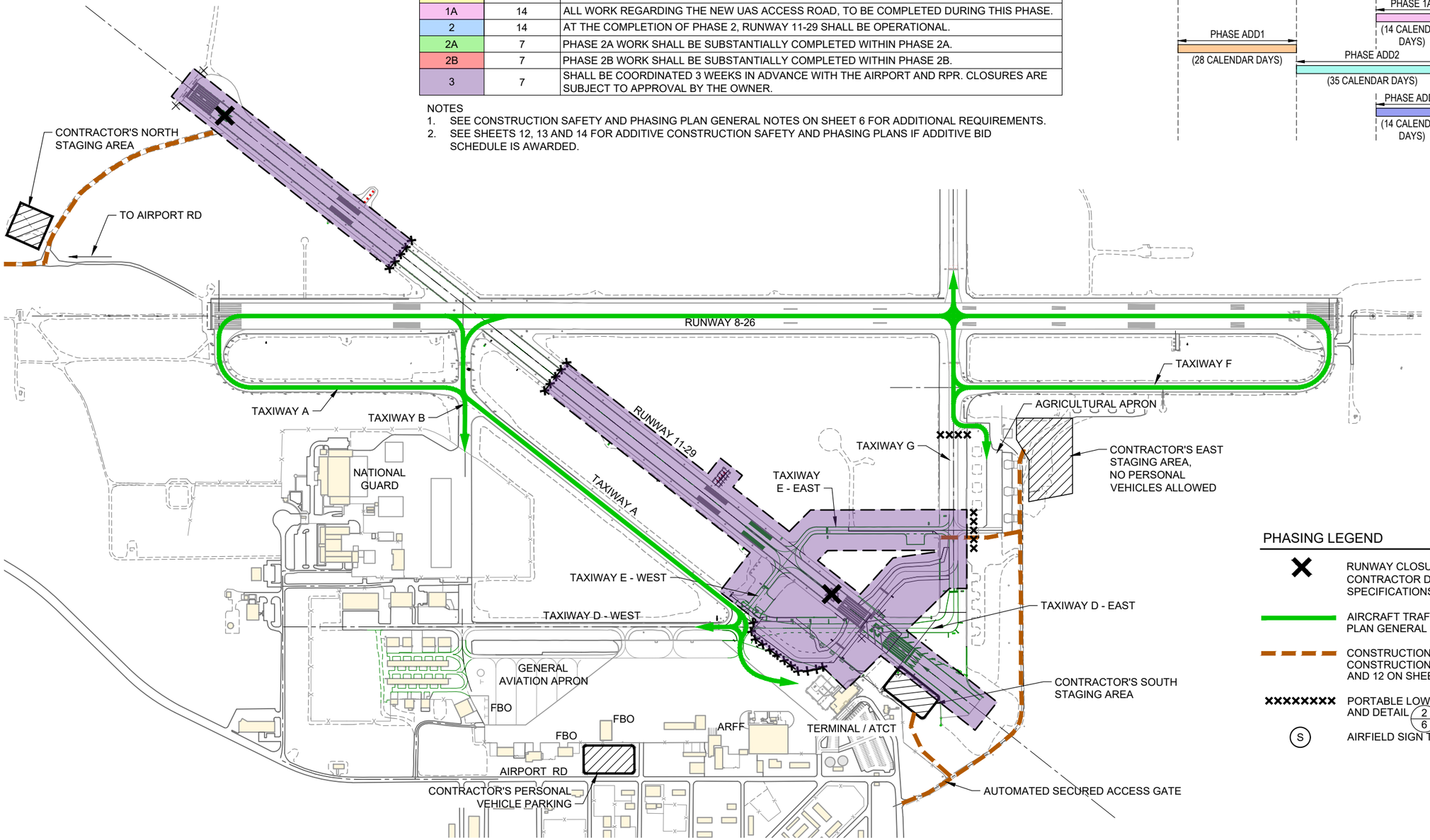
PROJECT CONSTRUCTION SCHEDULE





NORTH

0 150 300 600

SCALE IN FEET

PHASE 3 WORK ELEMENTS

- PAVEMENT MARKING

PHASING LEGEND

- RUNWAY CLOSURE CROSS TO BE DEPLOYED AND MAINTAINED BY CONTRACTOR DURING PERIODS OF RUNWAY CLOSURE. SEE SPECIFICATIONS, AND DETAIL 1/6
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- (S) AIRFIELD SIGN TO BE SCREENED, SEE NOTE 10 ON SHEET 6

PRINT IN COLOR

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PRECISION APPROACH ENGINEERING
5125 Southwest Hout Street
Corvallis, OR 97333
541•754•0043

REGISTERED PROFESSIONAL ENGINEER
76512PE
DIGITALLY SIGNED
OREGON
MAY 21, 2014
TRACY L. MAY
EXPIRES: 12/31/2022

REVISIONS: DATE APPD.

DATE:	MAR 2022
DESIGN:	KJK
DRAWN:	JAW
CHECKED:	TLM
REVISION NUMBER:	0
SCALE:	AS SHOWN

EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

CONSTRUCTION SAFETY AND PHASING PLAN - PHASE 3

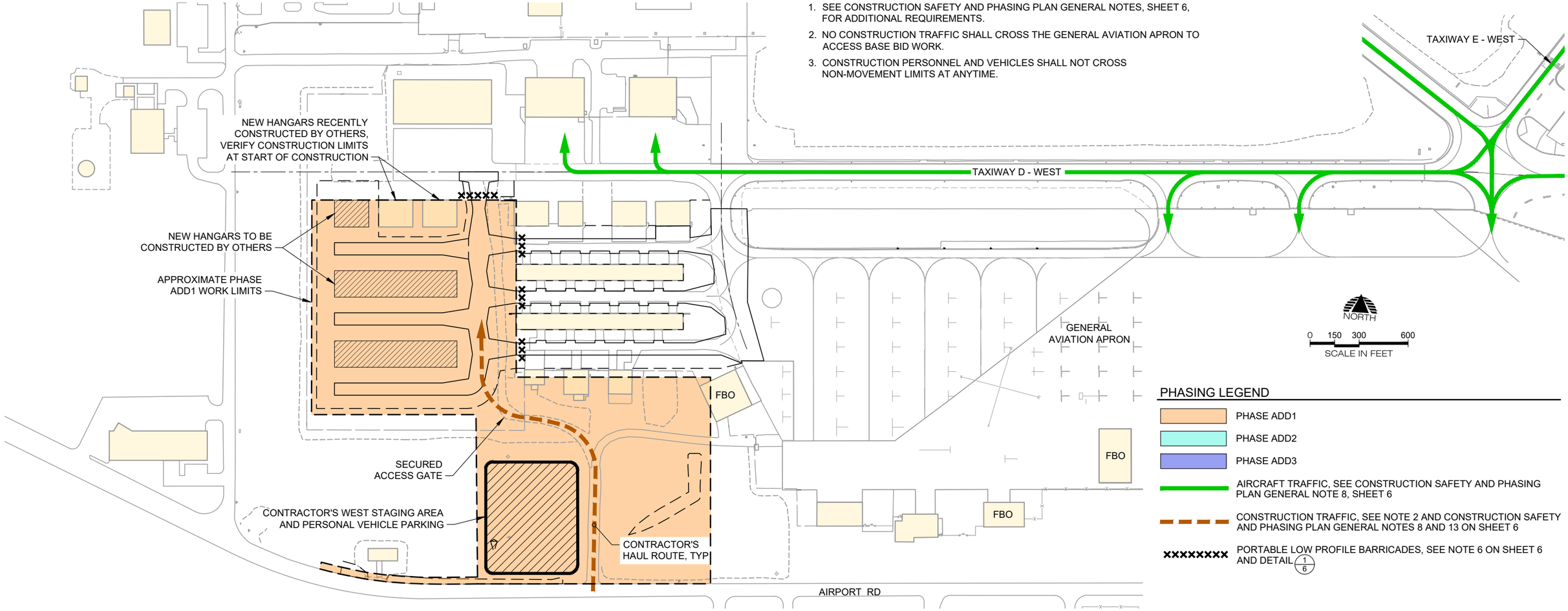
PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**

SHEET NO. **11** OF **102**

PHASING NOTES

1. SEE CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES, SHEET 6, FOR ADDITIONAL REQUIREMENTS.
2. NO CONSTRUCTION TRAFFIC SHALL CROSS THE GENERAL AVIATION APRON TO ACCESS BASE BID WORK.
3. CONSTRUCTION PERSONNEL AND VEHICLES SHALL NOT CROSS NON-MOVEMENT LIMITS AT ANYTIME.



PHASING LEGEND

- PHASE ADD1
- PHASE ADD2
- PHASE ADD3
- AIRCRAFT TRAFFIC, SEE CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTE 8, SHEET 6
- CONSTRUCTION TRAFFIC, SEE NOTE 2 AND CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES 8 AND 13 ON SHEET 6
- xxxxxxxx PORTABLE LOW PROFILE BARRICADES, SEE NOTE 6 ON SHEET 6 AND DETAIL 1/6

PROJECT CONSTRUCTION SCHEDULE NOTES

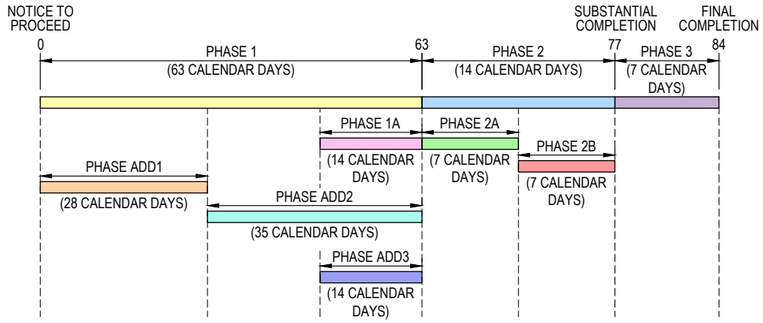
PHASE	CALENDAR DAYS	WORK ITEMS
ADD1	28	AT THE COMPLETION OF PHASE ADD1, THE NEW TAXILANES SHALL BE CONSTRUCTED, PREPARED AND READY FOR ASPHALT PAVING. ASPHALT PAVING SHALL BE COMPLETED DURING PHASE ADD2.
ADD2	35	AT THE COMPLETION OF PHASE ADD2, THE NEW AND REHABILITATED TAXILANES SHALL BE CONSTRUCTED AND READY FOR USE.
ADD3	14	AT THE COMPLETION OF PHASE ADD3, THE EXISTING APRON SHOULD BE CONSTRUCTED AND READY FOR USE.

NOTES
1. ALL PHASE WORK, AS OUTLINED ABOVE FOR EACH PHASE, SHALL BE COMPLETED WITHIN THE ALLOWABLE RESPECTIVE PHASE TIME.
2. TAXILANES TO BE CLOSED SIMILAR TO PHASE ADD2 FOR SECOND COAT OF PAVEMENT MARKING.

PHASE ADD1 WORK ELEMENTS

- PREPARE CONTRACTOR HAUL ROUTE AND STAGING AREAS
- EROSION CONTROL - ALL PROJECT AREAS
- DEMOLITION
- NEW TAXILANES CONSTRUCTION: EXCAVATION, SUBBASE, BASE
- DRAINAGE AND UTILITY IMPROVEMENTS
- SITE GRADING

PROJECT CONSTRUCTION SCHEDULE



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EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION

CONSTRUCTION SAFETY AND PHASING PLAN - PHASE ADD 1

PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**

SHEET NO. **12** OF **102**

PHASING NOTES

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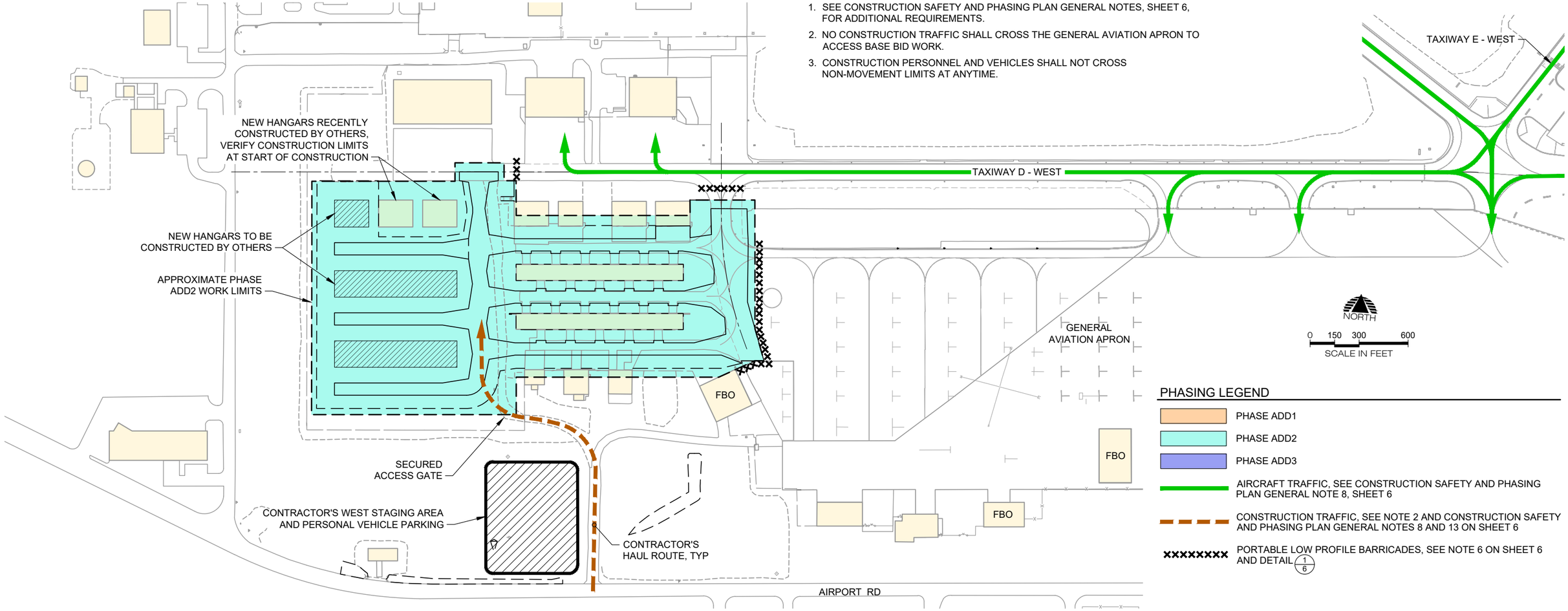

PHASING LEGEND

- PHASE ADD1
- PHASE ADD2
- PHASE ADD3
- AIRCRAFT TRAFFIC, SEE CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTE 8, SHEET 6
- CONSTRUCTION TRAFFIC, SEE NOTE 2 AND CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES 8 AND 13 ON SHEET 6
- XXXXXXXX PORTABLE LOW PROFILE BARRICADES, SEE NOTE 6 ON SHEET 6 AND DETAIL 1/6

PROJECT CONSTRUCTION SCHEDULE NOTES

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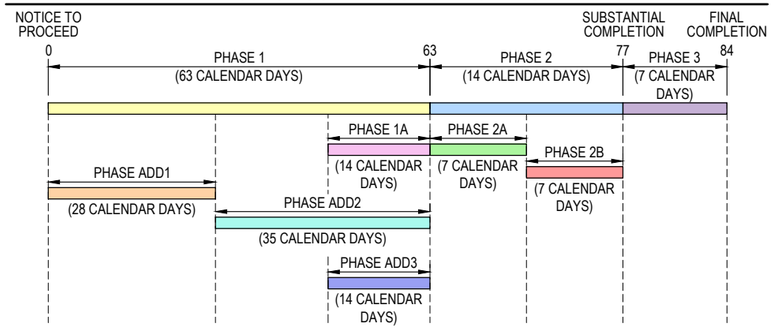
PHASE ADD2 WORK ELEMENTS

- ASPHALT PAVING - ALL AREAS
- 1ST COAT OF PAVEMENT MARKING - ALL AREAS
- FINAL SITE GRADING - ALL AREAS
- DEMOLITION
- NEW TAXILANES CONSTRUCTION: EXCAVATION, SUBBASE, BASE
- DRAINAGE AND UTILITY IMPROVEMENTS
- ALL WORK REQUIRED TO REACH PROJECT SUBSTANTIAL COMPLETION

PROJECT CONSTRUCTION SCHEDULE



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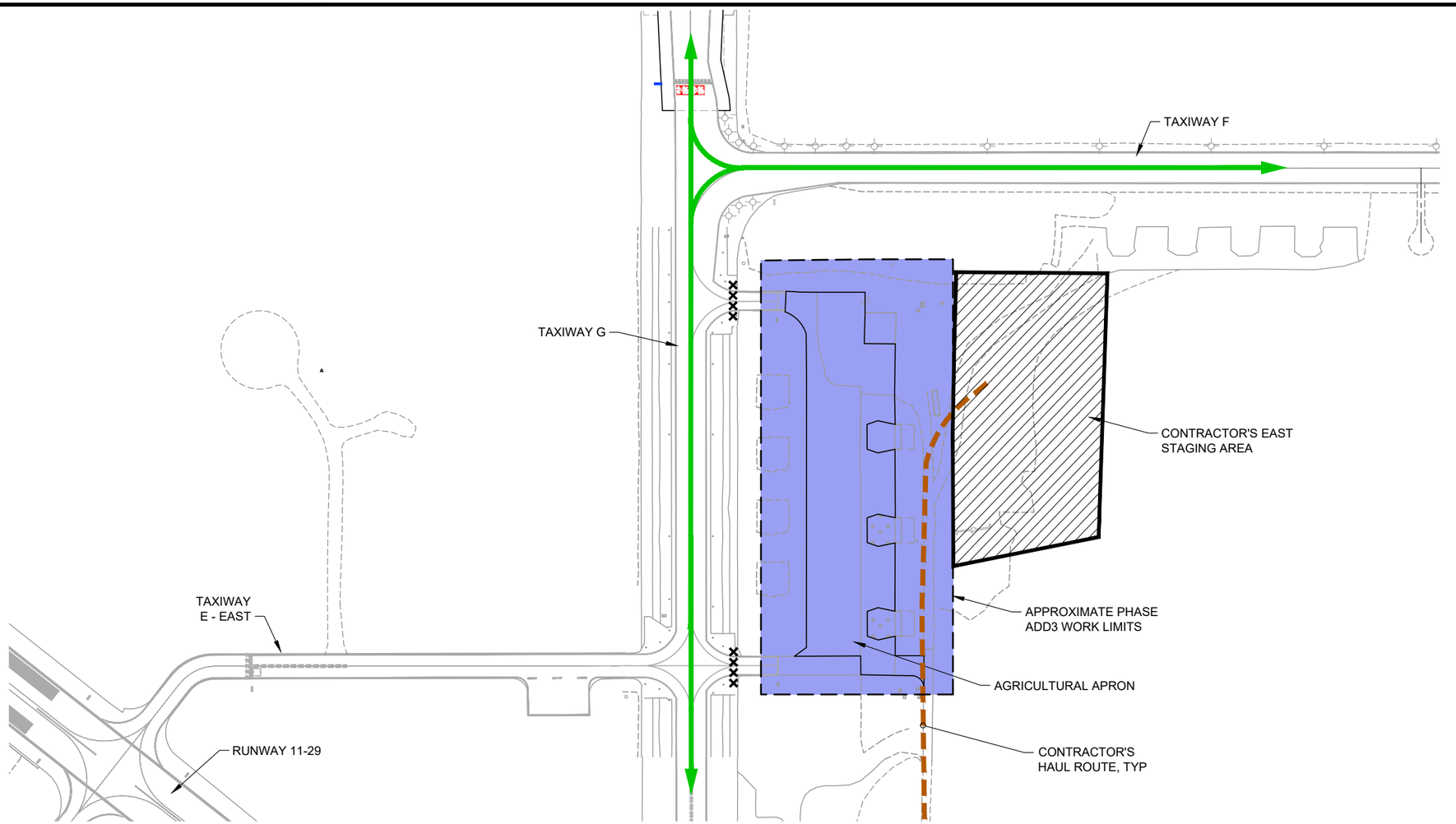
EASTERN OREGON REGIONAL AIRPORT AT PENDLETON
RUNWAY 29 THRESHOLD RELOCATION, NEW TAXILANES AND APRON REHABILITATION
CONSTRUCTION SAFETY AND PHASING PLAN - PHASE ADD 2
PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**
SHEET NO. **13** OF **102**



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NORTH

0 150 300 600

SCALE IN FEET

PHASING LEGEND

- PHASE ADD1
- PHASE ADD2
- PHASE ADD3
- AIRCRAFT TRAFFIC, SEE CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTE 8, SHEET 6
- CONSTRUCTION TRAFFIC, SEE NOTE 2 AND CONSTRUCTION SAFETY AND PHASING PLAN GENERAL NOTES 8 AND 13 ON SHEET 6
- XXXXXXXX PORTABLE LOW PROFILE BARRICADES, SEE NOTE 6 ON SHEET 6 AND DETAIL 1/6

PROJECT CONSTRUCTION SCHEDULE NOTES

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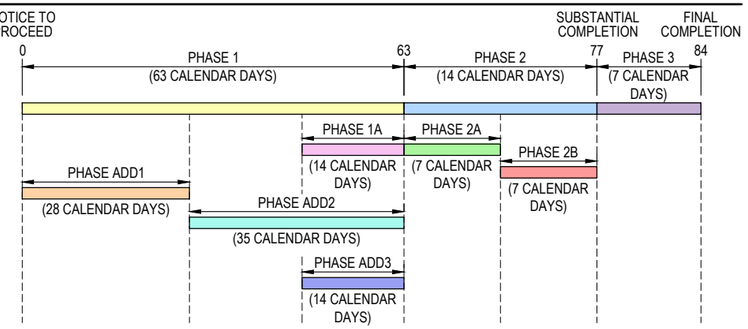
PHASE ADD3 WORK ELEMENTS

- DEMOLITION - INCLUDES ASPHALT MILLING FOR ASPHALT OVERLAY TIE-IN (NOTCH) TO MATCH EXISTING ASPHALT AND CONCRETE GRADES
- ADDITIONAL APRON AREA CONSTRUCTION: EXCAVATION, SUBBASE, BASE

PROJECT CONSTRUCTION SCHEDULE



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PRECISION APPROACH ENGINEERING, INC.
AIP NO. 3-41-0046-030-2022 AND 3-41-0046-028-2020

PROJECT NUMBER: **PND010**

SHEET NO. **14** OF **102**

ITEM C-100 CONTRACTOR QUALITY CONTROL PROGRAM (CQCP)

100-1 GENERAL. Quality is more than test results. Quality is the combination of proper materials, testing, workmanship, equipment, inspection, and documentation of the project. Establishing and maintaining a culture of quality is key to achieving a quality project. The Contractor shall establish, provide, and maintain an effective Contractor Quality Control Program (CQCP), that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The Contractor shall establish a CQCP that will:

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

b. Provide for the production of acceptable quality materials.

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

d. Document the CQCP process.

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

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

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

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

b. Discussion of the QA program.

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

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

e. Establishment of the overall QC culture.

100-2 DESCRIPTION OF PROGRAM.

a. General description. The Contractor shall establish a CQCP to perform QC inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. The CQCP shall ensure conformance to applicable specifications and plans with respect to materials, off-site fabrication, workmanship, construction, finish, and functional performance. The CQCP shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of QC.

b. Contractor Quality Control Program (CQCP). The Contractor shall describe the CQCP in a written document that shall be reviewed and approved by the RPR prior to the start of any production, construction, or off-site fabrication. The written CQCP shall be submitted to the RPR for review and approval at least 21 calendar days before the CQCP Workshop. The Contractor's CQCP and QC testing laboratory must be approved in writing by the RPR prior to the Notice to Proceed (NTP).

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

1. QC organization and resumes of key staff

2. Project progress schedule

3. Submittals schedule

4. Inspection requirements

5. QC testing plan

6. Documentation of QC activities and distribution of QC reports

7. Requirements for corrective action when QC and/or QA acceptance criteria are not met

8. Material quality and construction means and methods. Address all elements applicable to the project that affect the quality of the pavement structure including subgrade, subbase, base, and surface course. Some elements that must be addressed include, but is not limited to mix design, aggregate grading, stockpile management, mixing and transporting, placing and finishing, quality control testing and inspection, smoothness, laydown plan, equipment, and temperature management plan.

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

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

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

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

a. Program Administrator. The Contractor Quality Control Program Administrator (CQCPA) must be a full-time on-site during paving operations, 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 the 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 RPR when required by the technical specifications.

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

c. Staffing levels. The Contractor shall provide sufficient qualified QC personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The CQCPA 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/or Item P-404, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM D3666, *Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the RPR daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the CQCPA.

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

a. Daily inspection reports. Each Contractor QC technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician's daily reports shall provide factual evidence that continuous QC inspections have been performed and shall, as a minimum, include the following:

1. Technical specification item number and description

2. Compliance with approved submittals

3. Proper storage of materials and equipment

4. Proper operation of all equipment

5. Adherence to plans and technical specifications

6. Summary of any necessary corrective actions

7. Safety inspection.

8. Photographs and/or video

The daily inspection reports shall identify all QC inspections and QC tests conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

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

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

1. Technical specification item number and description

2. Test designation

3. Location

4. Date of test

5. Control requirements

6. Test results

7. Causes for rejection

8. Recommended remedial actions

9. Retests

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

100-10 CORRECTIVE ACTION REQUIREMENTS. The CQCP shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the CQCP as a whole, and for individual items of work contained in the technical specifications.

The CQCP shall detail how the results of QC inspections and tests will be used for determining the need for corrective action and shall contain clear rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and use statistical QC charts for individual QC tests. The requirements for corrective action shall be linked to the control charts.

100-11 INSPECTION AND/OR OBSERVATIONS BY THE RPR. All items of material and equipment are subject to inspection and/or observation by the RPR at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate QC system in conformance with the requirements detailed here and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to inspection and/or observation by the RPR at the site for the same purpose.

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

100-12 NONCOMPLIANCE.

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

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

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

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

METHOD OF MEASUREMENT

100-13 BASIS OF MEASUREMENT AND PAYMENT.

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

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

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

c. When 50% or more of the original contract is earned, an additional 20%.

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

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

BASIS OF PAYMENT

100-14 PAYMENT WILL BE MADE UNDER:

Bid Item No. 2	Contractor Quality Control Program (CQCP) - per Lump Sum
Bid Item No. A-2	Contractor Quality Control Program (CQCP) - per Lump Sum

REFERENCES

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

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

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

END OF ITEM C-100

Item C-102 TEMPORARY AIR AND WATER POLLUTION, SOIL EROSION, AND SILTATION CONTROL

DESCRIPTION

102-1. This item shall consist of temporary control measures as shown on the plans or as ordered by the Resident Project Representative (RPR) during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2, *Operational Safety on Airports During Construction*. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

102-2.1 GRASS. NOT USED

102-2.2 MULCHES. NOT USED

102-2.3 FERTILIZER. NOT USED

102-2.4 SLOPE DRAINS. NOT USED

102-2.5 SILT FENCE. Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

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

CONSTRUCTION REQUIREMENTS

102-3.1 GENERAL. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

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

102-3.2 SCHEDULE. Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the RPR.

102-3.3 CONSTRUCTION DETAILS. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans and approved CSPP. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The RPR shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the RPR.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the RPR. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the RPR, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The RPR may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

102-3.4 INSTALLATION, MAINTENANCE AND REMOVAL OF SILT FENCE. Silt fences shall extend a minimum of 16 inches (41 cm) and a maximum of 34 inches (86 cm) above the ground surface. Posts shall be set no more than 10 feet (3 m) on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch (300-mm) overlap and securely sealed. A trench shall be excavated approximately 4 inches (100 mm) deep by 4 inches (100 mm) wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. The silt fence shall be removed by the Contractor at the completion of the project, and only upon approval ~~of~~ by the RPR, Engineer and Owner.

METHOD OF MEASUREMENT

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

a. Measurement for all other temporary erosion control work required which is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls will be performed as scheduled, in compliance with local, state, and national laws and permits, as shown on the plans, or as ordered by the RPR. Completed and accepted work, not otherwise identified for separate measurement and payment, will be measured as lump sum.

b. Installation and removal of silt fence will be measured by the linear foot.

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

BASIS OF PAYMENT

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

Bid Item No. 3	Temporary Erosion Control – per Lump Sum
Bid Item No. 4	Installation and Removal of Silt Fence - per Linear Foot
Bid Item No. A-3	Temporary Erosion Control – per Lump Sum
Bid Item No. A-4	Installation and Removal of Silt Fence - per Linear Foot

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

REFERENCES

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

Advisory Circulars (AC)

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

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

ASTM International (ASTM)

ASTM D6461 *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

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

END OF ITEM C-102

ITEM C-105 MOBILIZATION

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

105-2 MOBILIZATION LIMIT. Mobilization shall be limited to 15 percent of the total project cost.

105-3 POSTED NOTICES. Prior to commencement of construction activities, the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster "Equal Employment Opportunity is the Law" in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL "Notice to All Employees" Poster; and Applicable Davis-Bacon Wage Rate Determination. Contractor shall also post all notices required by the State the work is being performed in. These notices must remain posted until final acceptance of the work by the Owner.

105-4 ENGINEER/RPR FIELD OFFICE. The Contractor shall provide at his expense a temporary office, services, utilities, equipment, and supplies at the Site for the use of the Resident Inspector. Structure shall be a minimum of 10 feet by 20 feet; weather-tight; and shall be provided with heat, ventilation, air conditioning, electric lights, adequate windows, and securable access. The following services shall be provided: at least 4 dual-plug 110 V electrical outlets. Power and water connection fees as well as all associated monthly service charges will be the responsibility of the Contractor. The following items, which may be used in common with the Contractor's facilities, shall be provided: wet (flush) toilet, potable water and soap for hand washing, potable water suitable for drinking, a use of a room with table and chairs to accommodate meeting of a minimum of fifteen (15) people. The use of a temporary portable wet toilet with a holding tank is acceptable only when a sanitary sewer is not available on the Site. Toilet tissue and paper hand towels shall be provided at all times. At the completion of the project, all the equipment provided will be returned to the Contractor.

Engineer's field office shall be located adjacent to the Contractor's staging area or as directed by the RPR. It may be possible for the Contractor to negotiate terms with the Owner to provide similarly acceptable facilities for use by the Resident Inspector.

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:

Bid Item No. 5	Mobilization - per Lump Sum
Bid Item No. A-5	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 (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 sublot in accordance with the requirements of the specification.

c. Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.

d. Find the sample average (X) for all sublot test values within the lot by using the following formula:

$$\mathbf{X = (x_1 + x_2 + x_3 + \ldots x_n) / n}$$

Where: X = Sample average of all sublot test values within a lot

$x_1, x_2, \ldots x_n$ = Individual sublot test values

n = Number of sublot test values

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

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

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

$d_1, d_2, \ldots d_n$ = Deviations of the individual sublot test values $x_1, x_2, \ldots$ from the average value X

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

n = Number of sublot 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:

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

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:

$$\mathbf{Q_L = (X - L) / S_n}$$
and
$$\mathbf{Q_U = (U - X) / S_n}$$

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:

$$\mathbf{PWL = (P_U + P_L) - 100}$$

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.

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

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

X = 97.95% density

3. Calculate the standard deviation for the lot.

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

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

$S_n = 1.15$

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.

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

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

X = 3.57%

3. Calculate the standard deviation S_n for the lot.

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

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

$S_n = 1.12$

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 × 1.15) = 99.63%

OR

less than (97.95 - 1.463 × 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

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

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

Percent Within Limits (P_L and P_U)	Negative Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
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

SECTION V

TECHNICAL SPECIFICATIONS

ITEM E-110 DEMOLITION

DESCRIPTION

110-1.1 This item covers the labor and materials necessary for demolition and disposal of all items shown on the plans, including: old electrical structures and equipment, PAPI units and foundations, and associated fixtures and foundations, electrical signs and sign bases, drain pipe, drainage structures, electrical fixtures, conduit and cables, duct markers, buried cable, and backfilling and re-compaction of disturbed areas. This item includes removal from the site of all demolition materials except those items specifically identified by the RPR or shown on the drawings to be salvaged, reused, provided to the owner, and placed in the stored location identified by the Owner or Engineer. The removal of pavement marking is not part of this specification.

Removal of storm drain pipe, conduit, wire, and other structures not specifically identified for payment herein or on the drawings shall be considered incidental to this Specification.

CONSTRUCTION METHODS

110-2.1 UTILITIES. The Contractor shall be responsible for determining specific locations for all existing utilities in the area of demolition prior to beginning demolition. All utilities not identified on the drawings for removal are to be protected. The Contractor shall be responsible for coordinating and meeting the requirements of the utility companies and FAA.

110-2.2 REMOVAL OF STRUCTURES. All pipe, conduit, culverts, electrical handholes, edge light cans and fixtures, conduit, cable, and other facilities identified for removal or encountered in excavation shall be removed in their entirety including foundations, pipes, asphalt, and all other appurtenances. Underground circuiting, including existing wire, conduit, and duct banks shall be removed and disposed of offsite when encountered, unless otherwise directed by the RPR or shown on the drawings.

Contractor shall coordinate with Owner for removal of existing electrical sign rectifiers prior to disposal of existing signage. Contractor shall salvage all existing frangible couplings and L-830 transformers associated with items to be demolished.

Locations of structures shown for removal are approximate and shall be field verified by the Contractor. Additional structures, not shown on the drawings, may require removal as directed by the RPR.

All materials and piping, except as specified for salvage, within the limits of the demolition, shall be removed from the site and become the property of the Contractor unless otherwise shown on the drawings or identified herein.

110-2.3 CONCRETE REMOVAL. The contractor shall remove the concrete features dimensioned or otherwise identified on the drawings. All material removed from the demolition areas shall be disposed off-site. Concrete removal is included in the lump sum unit cost for work covered under this Specification.

110-2.4 BACKFILLING. The contractor shall backfill all demolition areas approximately to the level of adjacent surfaces, as applicable.

Unless otherwise specified, backfill material and compaction of items removed from non-paved areas shall meet the requirements specified in Section P-152. Demolition debris shall not be used as backfill material. In all areas not backfilled to ground level, the Contractor shall erect safety barriers around the excavation.

In paved areas, backfilling of trenches where pipe, conduit, drainage or electrical structures have been removed shall conform to the trench backfill requirements as shown on the drawings. All costs of labor, equipment, and materials required to complete this item shall be considered incidental to this Specification.

110-2.5 PAVEMENT MARKING REMOVAL. Pavement Marking Removal shall be included in the Specification Section P-101, Surface Preparation.

110-2.6 PAVEMENT REMOVAL. Pavement removal shall be included in the Specification Section P-101, Surface Preparation.

MEASUREMENT

110-3.1 The quantity of Demolition shall be one item, complete. Measurement shall include all items identified or required to be removed or altered that are not covered by, or incidental to, other bid items. This measurement includes the removal and storage of electrical or other items to be salvaged as shown on the Drawings. No separate measurement or payment will be made for salvage. All measurements shall be subject to verification by the RPR.

BASIS OF PAYMENT

110-4.1 Payment shall be made under the Lump Sum unit price for Demolition. This price shall be full compensation for furnishing all materials; for all preparation, saw cutting, trenching, excavation, re-compacting, hauling, salvage and storage, removal and disposal of materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Bid Item No. 6	Demolition - per Lump Sum
Bid Item No. A-6	Demolition - per Lump Sum

END OF ITEM E-110

ITEM E-180 GEOTEXTILE FABRIC

DESCRIPTION

180-1.1 This item shall consist of furnishing and placing geotextile fabric as shown on the drawings or as directed by the RPR.

EQUIPMENT AND MATERIALS

180-2.1 GEOTEXTILE FABRIC. Woven geotextile fabric shall meet the requirements of 2021 Oregon Department of Transportation (ODOT) Section 02320 and Table 1 below.

180-2.2 FIELD SEAM STITCHING EQUIPMENT. Use field seam stitching equipment that provides an acceptable lock-type stitch as recommended by the geotextile manufacturer and approved by the RPR.

180-2.3 CERTIFICATION. The Contractor shall furnish the vendor's certified test reports for each lot of geotextile fabric shipped to the project. The report shall be delivered to the RPR before permission is granted for use of the geotextile fabric. The furnishing of the vendor's certified test report for the material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of geotextile fabric received for use in the project.

Table 1
GEOTEXTILE PROPERTY VALUES [1]

Geotextile Property	ASTM Test Method	Unit	Minimum Values	
			Woven	Non-Woven
Grab Tensile Strength (minimum) Machine & Cross Machine Directions	D 4632	lb	180	113
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632.	%	< 50	≥ 50
Tear strength (minimum)	D 4533	lb	68	41
Puncture strength (minimum)	D 6241	lb	371	223
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	--	30	30
Permittivity (minimum)	D 4491	sec-1	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

180-3.1 ACQUISITION AND STORAGE. Provide complete rolls of geotextile as furnished by the manufacturer and protect against damage and deterioration. Store all geotextile rolls in a dry place and off the ground at all times according to ASTM D 4873. Cover all rolls and partial rolls with a dark protective covering when received. The geotextile will be rejected for use if the RPR determines it has defects, deterioration, or has been damaged.

180-3.2 PLACEMENT. Prepare the surface receiving the geotextile to a smooth condition free of obstructions, depressions, and debris unless otherwise directed. Do not drag the geotextile on the ground or mishandle in any way.

Loosely place the geotextile without wrinkles so placement of the overlying material will not tear the geotextile. Lap or sew the geotextile at the ends and sides of adjoining sheets as specified.

Correct geotextile failures, as evidenced by soil pumping or roadbed distortion, by removing any covering material in the affected area and placing a geotextile patch on the exposed geotextile according to specifications for repair of the geotextile. Cover the patch with the specified cover material and compact before proceeding.

180-3.3 OVERLAPS. Minimum overlap requirement is 24 inches.

180-3.4 FIELD SEAMS. Field seams shall conform to ODOT Section 00350.41.

180-3.5 PROTECTION OF GEOTEXTILE. Protect the geotextile at all times from ultraviolet (UV) rays, contamination by surface runoff, and construction activities.

Traffic or construction equipment will not be permitted directly on the geotextile. When placed for construction, cover the geotextile with specified cover material as soon as possible. Do not leave in uncovered condition for more than 5 days.

Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 6-inch-thick cover layer, or twice the maximum aggregate size, whichever is thicker. End-dumping cover material directly on the geotextile will not be permitted.

180-3.6 REPAIR OF GEOTEXTILE. Repair or replace all torn, punctured, or contaminated geotextiles during construction at no cost to the Owner. Repair by placing a patch of the specified geotextile over the affected area. Overlap the existing geotextile with the patch according to overlap specifications. Where geotextile seams are required to be sewn, repair any damaged sheet by sewing unless otherwise indicated on the drawings, or as directed by the RPR.

METHOD OF MEASUREMENT

180-4.1 The quantity of geotextile fabric installation will be measured along the lines and grades of the installation to the nearest square yard of surface area actually covered according to the plans or as required.

BASIS OF PAYMENT

180-5.1 Payment shall be made at the contract unit price per square yard for geotextile fabric. This price shall be full compensation for all preparation of the existing surface, furnishing and installation of the geotextile, including all labor, equipment, tools, and incidentals necessary to complete the item. No separate payment will be made for constructing laps, seams, joints, and patches.

Payment will be made under:

Bid Item No. 7	Geotextile Fabric - per Square Yard
Bid Item No. A-7	Geotextile Fabric - per Square Yard

REFERENCES

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

ASTM International (ASTM)

ASTM D 3405	Specification for Joint Sealants, Hot Poured, for Concrete and Asphalt Pavement
ASTM D 4632	Breaking Load and Elongation of Geotextiles (Grab Method)
ASTM D 276	Identification of Fibers in Textiles
ASTM D 4354	Sampling of Geotextiles for Testing

END OF ITEM E-180

ITEM E-190 SHOULDER GRADING

DESCRIPTION

190-1.1 This item shall consist of materials and work necessary to excavate, place, grade, and compact areas under this contract in accordance with these specifications, and conforming to the lines and grades shown on the drawings or as directed by the RPR.

MATERIALS

190-2.1 Asphalt Pavement grindings generated by cold milling shall be placed as indicated on the plans or as directed by the RPR.

190-2.2 Material used to backfill and grade Site Grading areas shall be fine, readily compactible, granular soil selected from the excavation, as approved by the Engineer, and shall conform to the requirements for embankments as specified in Section P-152-2.8 and in conformance with the grades shown on the drawings.

190-2.3 Material used to backfill and grade Taxiway, Taxilane, Apron shoulders and other areas within the limits shown on the drawings shall consist of crushed aggregate material conforming to ODOT Section 02630 for Dense Graded Aggregate - 3/4”- 0.

CONSTRUCTION METHODS

190-3.1 GENERAL. All areas for this work shall be reviewed in the field after layout of limits as shown on the drawings and coordinated with the Engineer before construction. Unless otherwise specified, all work shall comply with Section P-152 Excavation and Embankment.

190-3.1 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project, in first-class working condition, and approved by the RPR before construction is permitted to start.

190-3.2 PREPARING UNDERLYING COURSE. All vegetation shall be stripped to a minimum 4-inch depth and the subgrade shall be compacted to a firm unyielding condition. The subgrade shall be accepted by the RPR before any pavement grinding placement begins. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected, compacted and rolled to smooth grades.

190-3.3 PLACING AND SPREADING. The material shall have satisfactory moisture content when rolling is started, and any minor variations prior to or during rolling shall be corrected by sprinkling or aeration, if necessary.

190-3.4 FINISHING AND COMPACTING. After spreading, the backfill material shall be thoroughly compacted to a dense and unyielding condition as approved by the RPR. Blading and rolling shall be done alternately, as required or directed, to obtain a smooth, even, and uniformly compacted surface.

The shoulders shall not be rolled when the underlying surface is soft or yielding or when the rolling causes undulation in the underlying course. In areas inaccessible to a roller, the material shall be tamped thoroughly with mechanical tampers. If necessary, the sprinkling during rolling shall be in the amount and by equipment approved by the RPR.

190-3.5 SURFACE TEST. After the shoulders have been completely compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified, reshaped, re-compacted, and otherwise manipulated as the RPR may direct until the required smoothness and accuracy are obtained. The finished surface shall not vary more than $\pm$0.05 foot from plan elevation at any point.

190-3.6 PROTECTION. Work on the shoulders shall not be accomplished during freezing temperatures. When the backfill material contains frozen material or when the underlying course is frozen, the construction shall be stopped.

METHOD OF MEASUREMENT

190-4.1 Site Grading, Asphalt Millings Placement will be measured by the square yard of asphalt millings placed, graded, compacted and measured in its final position. No measurement or payment will be made for material placement outside the limits as designated on the drawings, or as otherwise directed by the RPR. Measurement shall not include asphalt millings material that is stockpiled, and not placed, graded or compacted.

190-4.2 Site Grading will be measured by the square yard of selected backfill material placed, graded, compacted, and measured in its final position. No measurement or payment will be made for grading outside the limits authorized by the RPR. Measurement shall not include material that is stockpiled, and not placed, graded or compacted.

190-4.3 Site Grading, Aggregate Shoulder Grading will be measured by the square yard of Aggregate placed, graded, and compacted in its final position from the edge of new or existing pavements to the new aggregate shoulder limits as designated on the drawings, or as otherwise directed by the RPR. No measurement or payment will be made for material placement outside the limits as designated on the drawings, or as otherwise directed by the RPR.

BASIS OF PAYMENT

190-5.1 Payment of Site Grading, Asphalt Millings Placement shall be made at the Contract unit price per square yard of asphalt millings placed. This price shall be full compensation for all preparation, hauling, stockpiling, material handling, placement, grading, and compaction of asphalt milling materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

190-5.2 Payment of Site Grading shall be made at the Contract unit price per square yard of selected backfill material placed. This price shall be full compensation for all preparation, all required excavation, all hauling, stockpiling, material handling, placement, grading, and compaction of selected backfill material; and for all labor, equipment, tools, and incidentals necessary to complete the item.

190-5.3 Payment of Site Grading, Aggregate Shoulder Grading shall be made at the Contract unit price per square yard of shoulder aggregate placed, graded and compacted. This price shall be full compensation for furnishing all materials; for all preparation, hauling, placing and compacting of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item. Any excavation needed to place the material at appropriate grades shall be considered incidental to the Site Grading, Aggregate Shoulder Grading bid item.

Payment will be made under:

Bid Item No. 8	Site Grading, Asphalt Millings Placement - per Square Yard
Bid Item No. 9	Site Grading - per Square Yard
Bid Item No. A-8	Site Grading, Aggregate Shoulder Grading - per Square Yard

END OF ITEM E-190

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, pavement crack sealing, pavement crack repair, pavement marking removal, 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 Resident Project Representative (RPR). The equipment shall not cause damage to the pavement to remain in place.

101-2.1 All equipment shall be specified hereinafter, required to satisfactorily remove pavement, pavement marking, and seal pavement cracks as described in Section 101-3, or as approved by the Engineer. In general, no equipment used for marking removal shall cause damage to the pavement to remain in place.

101-2.2 ROUTER. A vertical spindle router with a diamond bit shall be used to create a sealant reservoir prior to crack sealing operations by enlarging meandering cracks to the depth and width specified in the drawings. If damage to the pavement is observed, work shall be discontinued until corrective action is taken. Such corrective action may require replacing worn router bits, changing operators, or replacing the equipment completely.

101-2.3. CRACK SEALANT. Crack sealant shall be a premixed, prepackaged material meeting the requirements of ASTM D 6690, Type 2 or 3. Each lot or batch of sealing compound 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, and the safe heating temperature, and shall be accompanied by the manufacturer's certification stating that the compound meets the requirements of this Specification.

101-2.4 PAVEMENT MARKING REMOVAL. All existing pavement markings scheduled for demolition shall be removed by mechanical means using Ultra-High Pressure (UHP) water. Hydro-blasting equipment must simultaneously recover all liquid and solid debris in conjunction with the marking removal process.

CONSTRUCTION METHODS

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. Full depth saw cuts shall be made perpendicular to the slab surface. The Contractor shall saw through the full depth of the slab including any dowels at the joint, removing the pavement and installing new dowels as shown on the plans and per the specifications. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, the perimeter shall be saw cut the full depth of the pavement. The pavement inside the saw cut shall be removed by methods which will not cause distress in the pavement which is to remain in place. Concrete slabs that are damaged by under breaking shall be repaired or removed and replaced as directed by the RPR. Concrete pavement removed shall be disposed of offsite.

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Spall and underbreak repair shall be in accordance with the plans. Any underlaying material that is to remain in place, shall be recompacted and/or replaced as shown on the plans. Adjacent areas damaged during repair shall be repaired or replaced at the Contractor's expense.

b. Asphalt concrete pavement. Areas of full depth pavement to be removed are depicted on the drawings. The RPR will verify the exact boundaries in the field after survey layout in accordance with the design. Asphalt pavement to be removed shall be cold milled to the full depth of the asphalt pavement, and it shall be broken to a maximum particle size of 1-1/2 inches. Asphalt pavement millings shall be placed and stockpiled as indicated on the drawings. Cuts in areas where existing pavement is to be matched shall be made by sawcut.

After existing pavement is removed by cold milling, unless otherwise specified or directed, for the final lift the perimeter shall be sawcut to form a vertical face. Unless otherwise required in P-401, lower lifts that match existing pavements, shall have a vertical sawcut face unless otherwise approved.

Where applicable, care shall be exercised during removal to minimize disturbance to existing materials and utilities. Any damage to adjoining pavement or utilities, as a result of either the cutting, cold milling or contractor operations, will be repaired by the Contractor at no cost to the Owner. Disturbed base material shall be re-compacted. No direct payment for sawcutting or re-compacting base material shall be made.

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. Remove all vegetation and debris from cracks to a minimum depth of 1 inch (25 mm). If extensive vegetation exists treat the specific area with a concentrated solution of a water-based herbicide approved by the RPR. Fill all cracks greater than ¼ inch (6mm) wide) with a crack sealant per ASTM D6690. The crack sealant, preparation, and application shall be compatible with the surface treatment/overlay to be used. To minimize contamination of the asphalt with the crack sealant, underfill the crack sealant a minimum of 1/8 inch (3 mm), not to exceed ¼ inch (6 mm). Any excess joint or crack sealer shall be removed from the pavement surface.

Wider cracks (over 1-1/2 inch wide (38 mm)), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as indicated on the drawings.

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 RPR in the field during construction.

High-pressure water shall be used to remove all foreign substances and contaminates. 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 RPR 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 RPR.

Removal of foreign substances shall not proceed until approved by the RPR. 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.

a. Repair of concrete spalls in areas to be overlaid with asphalt. The Contractor shall repair all spalled concrete as shown on the plans or as directed by the RPR. The perimeter of the repair shall be saw cut a minimum of 2 inches (50 mm) outside the affected area and 2 inches (50 mm) deep. The deteriorated material shall be removed to a depth where the existing material is firm or cannot be easily removed with a geologist pick. The removed area shall be filled with asphalt mixture with aggregate size appropriately for the depth of the patch. The material shall be compacted with equipment approved by the RPR until the material is dense and no movement or

marks are visible. The material shall not be placed in lifts over 4 inches (100 mm) in depth. This method of repair applies only to pavement to be overlaid.

b. Asphalt pavement repair. The Contractor shall repair all spalled concrete as shown on the plans or as directed by the RPR. The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. Materials and methods of construction shall comply with the other applicable sections of these specifications.

101-3.5 COLD MILLING. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a uniform finished surface. The milling machine or grinder shall operate without tearing or gouging the underlaying surface. The milling machine or grinder shall be equipped with grade and slope controls, and a positive means of dust control. All millings shall be removed and disposed 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 that was 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 RPR shall layout the area to be milled with a straightedge in increments of 1-foot (30 cm) widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn't have the appropriate milling machine, or areas that are damaged because of his negligence, shall be repaired by the Contractor at the Contractor's Expense.

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of 6 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 (+0 mm and -6mm) of the specified grade. The machine must cut vertical edges and have a positive method of dust control. The machine must have the ability to remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of in areas designated on the plans.

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

101-3.6. PREPARATION OF ASPHALT PAVEMENT SURFACES. Existing asphalt pavements to be treated with a surface treatment shall be prepared as follows:

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

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

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

d. Clean pavement surface immediately prior to placing the surface treatment so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.

101-3.7 MAINTENANCE. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the RPR. 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. Prior to application of sealant material, clean and dry the joints of all scale, dirt, dust, old sealant, curing compound, moisture and other foreign

matter. The Contractor shall demonstrate, in the presence of the RPR, that the method used cleans the joint and does not damage the joint.

101-3.8.1 REMOVAL OF EXISTING JOINT SEALANT. All existing joint sealants will be removed by plowing or use of hand tools. Any remaining sealant and or debris will be removed by use of wire brushes or other tools as necessary. Resaw joints removing no more than 1/16 inch (2 mm) from each joint face. Immediately after sawing, flush out joint with water and other tools as necessary to completely remove the slurry.

101-3.8.2 CLEANING PRIOR TO SEALING. Immediately before sealing, joints shall be cleaned by removing any remaining laitance and other foreign material. Allow sufficient time to dry out joints prior to sealing. Joint surfaces will be surface-dry prior to installation of sealant.

101-3.8.3 JOINT SEALANT. Joint material and installation will be in accordance with Item P-605.

101-3.9 PREPARATION OF CRACKS IN FLEXIBLE PAVEMENT PRIOR TO SEALING. Prior to application of sealant material, clean and dry the joints of all scale, dirt, dust, old sealant, curing compound, moisture and other foreign matter. The Contractor shall demonstrate, in the presence of the RPR, that the method used cleans the cracks and does not damage the pavement.

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

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

101-3.9.3 Crack Sealant. Crack sealant material and installation will be in accordance with Item P-101-3.2.

METHOD OF MEASUREMENT

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

Foreign substances/contaminates removed as part of pavement removal operations will not be paid for separately and will be considered incidental to the asphalt pavement removal, full depth bid item.

Dowel bar installation shall be incidental to pavement removal.

101-4.2 Pavement Removal, Partial Depth. The unit of measurement for pavement removal shall be the number of square yards removed by the Contractor. The location and 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 only once for the total depth of milling.

Foreign substances/contaminates removed as part of cold milling operations will not be paid for separately and will be considered incidental to the pavement removal bid item.

101-4.3 Pavement Crack Sealing. The unit of measurement for pavement crack sealing shall be the linear foot of crack prepared, sealed, and accepted as complete by the RPR.

101-4.4 Pavement Crack Repair. The unit of measurement for pavement crack repair shall be the linear foot of crack prepared, repaired, and accepted as complete by the RPR.

101-4.5 Removal of Foreign Substances/contaminates. The unit of measurement for foreign Substances/contaminates removal shall be the square foot.

BASIS OF PAYMENT

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

Bid Item No. 10	Asphalt Pavement Removal, Full Depth – per Square Yard
Bid Item No. 11	Asphalt Pavement Removal, Partial Depth – per Square Yard
Bid Item No. 12	Pavement Crack Sealing – per Linear Foot
Bid Item No. 13	Pavement Crack Repair – per Linear Foot
Bid Item No. 14	Removal of Foreign Substances/Contaminates – per Square Foot
Bid Item No. A-9	Asphalt Pavement Removal, Full Depth – per Square Yard
Bid Item No. A-10	Asphalt Pavement Removal, Partial Depth – per Square Yard
Bid Item No. A-11	Pavement Crack Sealing – per Linear Foot
Bid Item No. A-12	Pavement Crack Repair – per Linear Foot
Bid Item No. A-13	PCC Pavement Removal, Full Depth – 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

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.

The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations; and all pumping or other approved measures for the removal or exclusion of water, including storm water, reaching the site from any source so as to prevent damage to the site. Slopes on the sides of temporary excavations shall be such as to ensure safe execution of the work in accordance with applicable governmental requirements and regulations.

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

a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature which is not otherwise classified and paid for under one of the following items.

b. 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 offsite. Materials containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the RPR.

Unsuitable material is defined as material the Engineer determines to be incapable of being compacted to specified density using ordinary methods at optimum moisture.

Excessive moisture in the material is not, by itself, sufficient cause for determining that the material is unsuitable. In-place drying techniques shall be employed prior to defining the material as unsuitable. In-place drying methods shall consist of windrowing, discing, turning, and otherwise manipulating the material to achieve drying and compaction. Vibratory or steel drum compaction equipment and rubber-tired excavation equipment shall not be used in unstable areas unless approved by the Engineer. No separate measurement or payment will be made for in-place drying.

CONSTRUCTION METHODS

152-2.1 GENERAL. Before beginning excavation, grading, and embankment operations in any area, the area shall be completely stripped, approximately, 4 inches in depth, to remove all vegetation.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed of offsite.

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

Areas outside of the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches (100 mm), to loosen and pulverize

the soil. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150 mm) of the subgrade.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the RPR, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

a. Blasting. Blasting shall not be allowed.

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

An electronic copy of the existing ground DTM file will be issued to the successful bidder. An electronic document media release agreement between the successful bidder and RPR shall be executed prior to release of any electronic documents.

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

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

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches (300 mm) below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed off the airport. The cost is incidental to this item. This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for Muck Excavation. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. Undercutting in areas of new pavement construction shall be backfilled with base material meeting all requirements of the P-154 Specification. 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 unclassified excavation muck excavation.

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

break that the RPR determines as avoidable. Unavoidable over-break will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor as indicated on the plans. All existing foundations shall be excavated at least 2 feet (60 cm) below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

152-2.3 BORROW EXCAVATION. Borrow areas are not required.

152-2.4 DRAINAGE EXCAVATION. 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 (150 mm) 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 (300 mm) and compacted as specified for the adjacent fill.

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

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

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

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

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

The lifts shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the RPR. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due of rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the

embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

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

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

The Contractor will take samples of excavated materials which will be used in embankment for testing and develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with D1557. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the Contractor for every 750 square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the RPR.

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

Rolling operations shall be continued until the embankment is compacted to not less than 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 percent 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, unless otherwise indicated on drawings or directed by the RPR, 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 D1556 or ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Contractor’s independent testing laboratory shall perform all density tests in the RPR’s presence and provide the test results upon completion to the RPR for acceptance. If the specified density is not attained, the area represented by the test or as designated by the RPR shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

Compaction areas shall be kept separate, and no lift shall be covered by another lift until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each lift is placed. Lift placement shall begin in the deepest portion of the embankment fill. As placement progresses, the lifts shall be constructed approximately parallel to the finished pavement grade line.

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

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

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

152-2.9 PROOF ROLLING. The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. 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 RPR. Apply a minimum of 2 coverage, or as specified by the RPR, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch (25 mm) or show permanent deformation greater than 1 inch (25 mm) shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

152-2.10 COMPACTION REQUIREMENTS. Compaction requirements apply equally to subgrade or soil preparation established by cutting or filling material. The subgrade under areas to be paved shall be compacted to a depth of 12 inches (300 mm) and to a density of not less than 100 percent 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 (300 mm) and to a density of not less than 95 percent of the maximum density as determined by ASTM D1557.

The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). When the material has greater than 30 percent retained on the ¾ inch (19.0 mm) sieve, follow the methods in ASTM D1557 Tests for moisture content and compaction will be taken at a minimum of 750 S.Y. of subgrade. All quality assurance testing shall be done by the Contractor's independent testing laboratory in the presence of the RPR, and density test results shall be furnished upon completion to the RPR for acceptance determination.

The in-place field density shall be determined in accordance with ASTM D1556 or 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 RPR and the finished subgrade shall be maintained.

152-2.11 FINISHING AND PROTECTION OF SUBGRADE. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

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

152-2.12 HAUL. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

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

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

152-2.13 SURFACE TOLERANCES. In those areas on which a subbase or base course is to be placed, the surface shall be tested by the Contractor in the presence of the RPR for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

a. Smoothness. The finished surface shall not vary more than +/- ½ inch (12 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +/-0.05 feet (15 mm) of the specified grade.

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

152-2.14 TOPSOIL. When topsoil is specified or required as shown on the plans, it shall be salvaged from stripping or other grading operations. 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 Construction Safety and Phasing Plan (CSPP), and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the RPR, 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. No direct payment will be made for topsoil under Item P-152. The quantity removed and placed directly or stockpiled shall be paid for at the contract unit price per cubic yard for "Unclassified Excavation." No additional payment for rehandling of topsoil shall be provided.

METHOD OF MEASUREMENT

152-3.1 Measurement for payment specified by the cubic yard shall be computed by the average end areas of design cross sections for computation of neat line design quantities. The end area is that bound by the original ground line established by field cross-sections and the final theoretical pay line established by cross-sections shown on the plans, subject to verification by the RPR.

152-3.2 The quantity of Unclassified Excavation and Muck Excavation excavation to be paid for shall be the number of cubic yards (cubic meters) measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

BASIS OF PAYMENT

152-4.1 Unclassified excavation and Muck Excavation payment 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:

Bid item No. 15	Unclassified Excavation - per Cubic Yard
Bid item No. 16	Muck Excavation - per Cubic Yard
Bid item No. A-14	Unclassified Excavation - per Cubic Yard
Bid item No. A-15	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 Software

Software

FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design

U.S. Department of Transportation

FAA RD-76-66	Design and Construction of Airport Pavements on Expansive Soils

END OF ITEM P-152

ITEM P-153 CONTROLLED LOW-STRENGTH MATERIAL (CLSM)

DESCRIPTION

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

MATERIALS

153-2.1 MATERIALS.

a. Cement. Cement shall conform to the requirements of ASTM C-150 Type I or II.

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 potable water sources. Other substances shall be tested in accordance with ASTM C1602 prior to use.

MIX DESIGN

153-3.1 PROPORTIONS. The Contractor shall submit, to the RPR, a mix design including the proportions and source of aggregate, fly ash, cement, water, and approved admixtures. No CLSM mixture shall be produced until the RPR 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 RPR. 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 RPR.

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 RPR 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 RPR 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 RPR 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

ITEM P-154 SUBBASE COURSE

DESCRIPTION

154-1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross-section shown on the plans.

MATERIALS

154-2.1 MATERIALS. The subbase material shall consist of hard durable particles or fragments of granular aggregates. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The material shall be free from vegetative matter, excessive amounts of clay, and other objectionable substances; uniformly blended; and be capable of being compacted into a dense, stable subbase.

The subbase material shall exhibit a California Bearing Ratio (CBR) value of at least 20 when tested in accordance with ASTM D1883. The subbase material shall meet the gradation specified in the table below.

Subbase Gradation Requirements

Sieve designation	Percentage by weight passing sieves	Contractor's Final Gradation	Job Control Grading Band Tolerances[1] (Percent)
	Subbase Aggregate		
3 inch (75 mm)	100		0
1 1/2 inch (37.5 mm)			0
3/4 inch (19.0 mm)	70-100		±10
No. 10 (2.00 mm)	20-100		±10
No. 40 (425 µm)	5-60		±5
No. 200 (75 µm)	0-10		±5

[1]The "Job Control Grading Band Tolerances" shall be applied to "Contractor's Final Gradation" to establish the job control grading band.

The portion of the material passing the No. 40 (425 µm) sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than six (6) when tested in accordance with ASTM D4318.

154-2.2 SAMPLING AND TESTING.

a. Aggregate base materials. Samples shall be taken by the Contractor per ASTM D75 for initial aggregate subbase requirements and gradation. Material shall meet the requirements in paragraphs 154-2.1. The Contractor

shall submit to the Resident Project Representative (RPR) certified test results showing that the aggregate meets the Material requirements of this section. Tests shall be representative of the material to be used for the project.

All tests for aggregate submittals necessary to determine compliance with the specification requirements will be made by the Contractor's independent testing laboratory specific to this project.

b. Gradation requirements. The Contractor shall take at least one aggregate subbase sample per day in the presence of the RPR to check the final gradation. Samples shall be taken from the in-place, un-compacted material at sampling locations determined by the RPR on a random basis per ASTM D3665. Sampling shall be per ASTM D75 and tested per ASTM C136 and ASTM C117. Results shall be furnished to the RPR by the Contractor each day during construction. Material shall meet the requirements in paragraph 154-2.1.

154-2.3 Separation Geotextile. See Specification E-180.

154-2.4 Geogrid. Not used.

CONSTRUCTION METHODS

154-3.1 GENERAL. The subbase course shall be placed where designated on the plans or as directed by the RPR. The material shall be shaped and thoroughly compacted within the tolerances specified.

Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support the construction equipment without movement, shall be mechanically modified to the depth necessary to provide stability as directed by the RPR. The mechanical modification shall include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing strength, so the course will not deform under construction equipment traffic.

154-3.2 PREPARING UNDERLYING COURSE. Prior to constructing the subbase course, clean the underlying course or subgrade of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances in accordance with Item P-152. Correct ruts, soft yielding spots in the underlying courses, and subgrade areas having inadequate compaction and/or deviations of the surface from the specified requirements, by loosening and removing soft or unsatisfactory material, adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the overlying course by mixing the overlying course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the overlying course is placed. The underlying course shall be checked and accepted by the RPR before placing and spreading operations are started.

To protect the subgrade and to ensure proper drainage, spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

154-3.3 CONTROL STRIP. The first half-day of subbase construction shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

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

154-3.4 PLACEMENT. The material shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, 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 material shall not be placed when the underlying course is soft or yielding.

The material shall meet gradation and moisture requirements prior to compaction. Material may be free-draining and the minimum moisture content shall be established for placement and compaction of the material.

The material 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.

154-3.5 COMPACTION. The subbase material shall be compacted, adjusting moisture as necessary, to be within ±2% of optimum moisture. The field density of the compacted material shall be at least 100% of the maximum density as specified in paragraph 154-3.9a. If the specified density is not attained, the area of the lift represented by the test shall be reworked and/or re-compacted and 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.

154-3.6 WEATHER LIMITATION. Material shall not be placed unless the ambient air temperature is at least 40°F (4°C) and rising. Work on subbase course shall not be conducted when the subgrade is wet or frozen or the subbase material contains frozen material.

154-3.7 MAINTENANCE. No base or surface course shall be placed on the subbase until the subbase has been accepted by the RPR. The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, the Contractor shall verify that materials still meet all specification requirements before placement of additional material. Equipment may be routed over completed sections of subbase course, provided the equipment does not damage the subbase course and the equipment is routed over the full width of the completed subbase course. Any damage to the subbase course from routing equipment over the subbase course shall be repaired by the Contractor at their expense.

154-3.8 SURFACE TOLERANCE. In those areas on which a subbase or base course is to be placed, the surface shall be tested by the Contractor in the presence of the RPR for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

a. Smoothness. The finished surface shall not vary more than +/- ½ inch (12 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +/-0.05 feet (15 mm) of the specified grade.

154-3.9 ACCEPTANCE SAMPLING AND TESTING. The 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 750 square yards. Sampling locations will be determined on a random basis per ASTM D3665.

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

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 D1556. **or** 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 shall 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.

When the material has greater than 30 percent retained on the ¾ inch (19.0 mm) sieve, use methods in ASTM D1557 and the procedures in AASHTO T180 Annex for correction of maximum dry density and optimum moisture for oversized particles.

b. Thickness. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by depth tests taken by the Contractor in the presence of the RPR 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.

Thickness acceptance may be determined by survey before and after placement with prior written approval from the RPR. The survey intervals shall be approved by the RPR prior to performing the surveys.

METHOD OF MEASUREMENT

154-4.1 Subbase course shall be measured by the number of cubic yards of subbase course material placed and compacted, to specified density and plan thickness requirements in the completed course. The quantity of subbase course material shall be measured in final position based upon survey of the complete work computed from elevations to the nearest 0.01 foot. On individual depth measurements, thicknesses more than 1/2 inch (12 mm) in excess of that shown on the plans shall be considered as the specified thickness plus 1/2 inch (12 mm) in computing the yardage for payment. Subbase materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

154-5.1 Payment shall be made at the contract unit price per cubic yard for subbase course. This price shall be full compensation for furnishing all materials; for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Bid Item No. 17	P-154 Subbase Course – per Cubic Yard
Bid Item No. A-16	P-154 Subbase 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 C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse 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 (2,700 kN-m/m^3))
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4759	Practice for Determining the Specification Conformance of Geosynthetics
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

American Association of State Highway and Transportation Officials (AASHTO)

M 288	Geotextile Specification for Highway Applications

END OF ITEM P-154

ITEM P-208 AGGREGATE BASE COURSE

DESCRIPTION

208-1.1 This item shall consist of a base course composed of coarse aggregate bonded with fine aggregate base. It shall be constructed on a prepared subgrade or subbase course per these specifications and shall conform to the dimensions and typical cross-section shown on the plans.

MATERIALS

208-2.1 AGGREGATE BASE. The aggregate base material shall consist of both fine and coarse aggregate. Material shall be clean, sound, durable particles and fragments of stone or gravel, crushed stone, or crushed gravel mixed or blended with sand, screenings, or other materials. Materials shall be handled and stored in accordance with all federal, state, and local requirements. The aggregate shall be free from clay lumps, organic matter, 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 nearly constant and uniform as practicable. The fine aggregate portion, defined as the portion passing the No. 4 (4.75 mm) sieve produced in crushing operations, shall be incorporated in the base material to the extent permitted by the gradation requirements. Aggregate base material requirements are listed in the following table.

Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 50% 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 60% by weight of particles with at least two fractured faces and 75% 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
Clay lumps and friable particles	Less than or equal to 3 percent	ASTM C142
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).

208-2.2 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 for Contractor's Final Gradation[1] Percent
2 inch (50 mm)	-		±0
1-1/2 inch (37.5 mm)	100		±5
1 inch (25.0 mm)	70-100		±8
3/4 inch (19.0 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40 (425 µm)	10-30		±5
No. 200 (75 µm)	0-5		±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.

208-2.3 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 paragraphs 208-2.1 and 208-2.2. 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 Resident Project Representative (RPR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 208-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the RPR.

208-2.4 SEPARATION GEOTEXTILE. See Specification E-180

CONSTRUCTION METHODS

208-3.1 CONTROL STRIP. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

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

208-3.2 PREPARING UNDERLYING SUBGRADE AND/OR SUBBASE. The underlying subgrade and/or subbase shall be checked and accepted by the RPR 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 RPR if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any

ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

208-3.3 PRODUCTION. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 208-3.5, the approved material may be transported directly to the placement.

208-3.4 PLACEMENT. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, 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 layer 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.

208-3.5 COMPACTION. Immediately upon completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density 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.

208-3.6 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.

208-3.7 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 their expense.

208-3.8 SURFACE TOLERANCES. After the course has been compacted, the surface shall be tested by the Contractor in the presence of the RPR for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. 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.

208-3.9 ACCEPTANCE SAMPLING AND TESTING. Aggregate base course shall be accepted for density and thickness on an area basis. Two tests will be made for density and thickness for each 750 square yards. Sampling locations will be determined on a random basis per ASTM D3665.

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

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 D1556 or 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 RPR 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.

Thickness acceptance may be determined by survey before and after placement with prior written approval from the RPR. The survey intervals should be the same as those specified in 208-3.8

METHOD OF MEASUREMENT

208-4.1 The quantity of aggregate base course shall be measured by the number of cubic yards of material actually constructed and accepted by the RPR as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

208-5.1 Payment shall be made at the contract unit price per cubic yard for aggregate base course. This price shall be full compensation for furnishing all materials and for all operations, hauling, placing, and compacting of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Bid Item No. 18	P-208 Aggregate Base Course - per Cubic Yard
Bid Item No. A-17	P-208 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-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM 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 D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM 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

END OF ITEM P-208

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, 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, 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
Clay lumps and friable particles	Less than or equal to 3 percent	ASTM C142
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 limited on one sieve to the high limit on an adjacent sieve or vice versa as defined by ASTM D2487 and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

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 mm)	70-95		±8
3/4 inch (19 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]	0-5		±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 Resident Project Representative (RPR) 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 RPR.

All tests for aggregate submittals necessary to determine compliance with the specification requirements will be made by the Contractor's independent testing laboratory.

209-2.4 SEPARATION GEOTEXTILE. See Item E-180 for requirements.

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 RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

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

209-3.2 PREPARING UNDERLYING SUBGRADE AND/OR SUBBASE. The underlying subgrade and/or subbase shall be checked and accepted by the RPR 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 RPR 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 PLACING. The aggregate base shall be placed and spread on the prepared underlying layers by spreader boxes or other devices as approved by the RPR, 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 subbase 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 by the Contractor in the presence of the RPR for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. 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 750 square yds. Sampling locations will be determined on a random basis per ASTM D3665

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

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 1557. The in-place field density shall be determined per ASTM D1556 or 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 RPR 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.

Thickness acceptance may be determined by survey before and after placement with prior written approval from the RPR. The survey intervals should be the same as those specified in 209-3.8

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 RPR 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:

Bid Item No. 19	P-209 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-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM 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

END OF ITEM P-209

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, 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 (27200 kg) or more: Minimum 75% by weight of particles with at least two fractured faces and 85% with at least one fractured face[1]	ASTM D5821
	For pavements designed for aircraft gross weights less than 60,000 pounds (27200 kg): Minimum 50% by weight of particles with at least two fractured faces and 65% with at least one fractured face[1]	
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 [2]	ASTM D4791
Bulk density of slag [3]	Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)	ASTM C29.

[1] The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

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

[3] Only required if slag is specified.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel and shall be free from coatings of clay, silt, or other objectionable matter. Natural (non-manufactured) sand may be used to obtain the gradation of the 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	ASTM D1073

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) 70-28.

Asphalt Binder shall also meet the minimum Elastic Recovery requirements as outlined in the table below:

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.

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

401-2.4 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 Resident Project Representative (RPR) 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 RPR for review and accepted in writing. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

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

The JMF shall be prepared by an accredited laboratory that meets the requirements of 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 RPR for review and accepted in writing before the new material is used. After the initial production JMF has been approved by the RPR and a new or modified JMF is required for whatever reason, the subsequent cost of the new or modified JMF, including a new control strip when required by the RPR, will be borne by the Contractor.

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

The JMF shall be submitted in writing by the Contractor at least [30] days prior to the start of paving operations. The JMF shall be developed within the same construction season using aggregates proposed for project use.

The 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.

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 , use Hamburg Wheel test (AASHTO T-324) 10mm @ 20,000 passes at 50°C.

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 2 when tested in accordance with ASTM C136 and ASTM C117.

The gradations in Table 2 represent the limits that shall determine the suitability of aggregate for use from the sources of supply; be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa.

Table 2. Aggregate - Asphalt Pavements

Sieve Size	Percentage by Weight Passing Sieve
1 inch (25.0 mm)	100
3/4 inch (19.0 mm)	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:	
Stone or gravel	5.0-7.5
Recommended Minimum Construction Lift Thickness	2 inch

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

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

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 RPR**.** The Contractor shall prepare and place a quantity of asphalt according to the JMF. The underlying grade or pavement structure upon which the control strip is to be constructed shall be the same as the remainder of the course represented by the control strip.

The Contractor will not be allowed to place the control strip until the Contractor quality control program (CQCP), showing conformance with the requirements of paragraph 401-5.1, has been accepted, in writing, by the RPR.

The control strip will consist of at least 250 tons (227 metric tons) or 1/2 sublot, 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 RPR 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 RPR, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)	
	°F	°C
3 inches (7.5 cm) or greater	40 [1]	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 RPR, or RPR's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

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

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

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 RPR 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 PRIME AND TACK COAT. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.

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

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

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 RPR. The laydown plan shall be submitted to the RPR a minimum of 7 days prior to the scheduled pre-paving conference, and a minimum of 14 days in advance of paving operations.

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. Clean-out of equipment and trucks shall be at location designed by the RPR. No mix or debris shall be placed within areas to be paved. Mix and debris within areas to be paved shall be removed prior to paving.

Contractor shall survey each lift of asphalt surface course and certify to RPR 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 RPR. The asphalt mix shall be placed in consecutive adjacent lanes having a minimum width of 15 feet except where edge lanes require less width to complete the area. Additional screed sections attached to widen the paver to meet the minimum lane width requirements must be heated and include additional auger sections to move the asphalt mixture uniformly along the screed extension.

In all areas to be paved, 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 RPR may at any time, reject any batch of asphalt, on the truck or placed in the mat, which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or overheated asphalt mixture. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

Areas of segregation in the surface course, as determined by the RPR, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of the construction lift thickness as specified in 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 grooving is not required.

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 RPR 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 RPR prior to the start of any nighttime work. All work shall be in accordance with the approved CSPP and lighting plan.

CONTRACTOR QUALITY CONTROL (CQC)

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 RPR shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

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

The Contractor may use a 12-foot (3.7 m) "straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using 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 as outlined above, and shall have variances less than ¼ inch in 12 feet, unless otherwise approved by the RPR.

(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 RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day's production placed. Longitudinal tests 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 (12 mm) vertically and 0.1 feet laterally. The documentation will be provided by the Contractor to the RPR 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 ½ inch and replacing with new material. Skin patching is not allowed.

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

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 RPR and kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the RPR may suspend production or acceptance of the material.

a. Individual measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The control charts shall use the

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 RPR

at no cost to the Contractor except that coring as required in this section shall be completed and paid for by the Contractor.

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

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

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

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

(1) Sampling. Material from each sublot 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 sublot 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 sublot 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 RPR.

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

(3) Thickness. Thickness of each lift of surface course will be evaluated by the RPR for compliance to the requirements shown on the plans after any necessary corrections for grade. Measurements of thickness will be made using the cores extracted for each sublot 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 sublot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the RPR to circumscribe the deficient area.

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

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

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 (12 mm) vertically or 0.1 feet laterally.

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, edge of paving panel, and edge of taxiway/Apron pavements.

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 sublot 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 RPR. 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 (kg) 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 sublot shall be reduced by 5%.

Table 6. Price adjustment schedule[1]

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

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

[2] The lot shall be removed and replaced. However, the RPR may decide to allow the rejected lot to remain. In that case, if the RPR 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:

Bid Item No. 20	P-401 Asphalt Surface Course - per Ton
Bid Item No. A-18	P-401 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-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM 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 Ductilometer
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 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 T 340 Standard Method of Test for Determining the Rutting Susceptibility of Hot Mix Asphalt (APA) Using the Asphalt Pavement Analyzer (APA)

Asphalt Institute (AI)

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

END OF ITEM P-401

ITEM P-602 EMULSIFIED ASPHALT PRIME COAT

DESCRIPTION

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

MATERIALS

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

CONSTRUCTION METHODS

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

602-3.2 EQUIPMENT. The equipment shall include a self-powered pressure asphalt material distributor and equipment for heating asphalt material.

Provide a distributor with pneumatic tires of such size and number that the load produced on the base surface does not exceed 65.0 psi (4.5 kg/sq cm) of tire width to prevent rutting, shoving or otherwise damaging the base, surface or other layers in the pavement structure. Design and equip the distributor to spray the asphalt material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 1.0 gallons per square yard (0.23 to 4.5 L/square meter), with a pressure range of 25 to 75 psi (172.4 to 517.1 kPa) and with an allowable variation from the specified rate of not more than ±5%, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying asphalt material manually to areas inaccessible to the distributor. Equip the distributor to circulate and agitate the asphalt material during the heating process. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

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

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

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

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

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

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

602-3.5 Freight and waybills. The Contractor shall submit waybills and delivery tickets during the progress of the work. Before the final estimate is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

602-4.1 The emulsified asphalt material for prime coat shall be measured by the ton. Volume shall be corrected to the volume at 60°F (16°C) in accordance with ASTM D4311. 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

602-5.1 Payment shall be made at the contract unit price per ton for emulsified asphalt prime coat. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Bid Item No. 21	Emulsified Asphalt Prime Coat - per Ton
Bid Item No. A-19	Emulsified Asphalt Prime Coat - 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 D2995	Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors
ASTM D3628	Standard Practice for Selection and Use of Emulsified Asphalts

END OF ITEM P-602

ITEM P-603 EMULSIFIED ASPHALT TACK COAT

DESCRIPTION

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

MATERIALS

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

CONSTRUCTION METHODS

603-3.1 WEATHER LIMITATIONS. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is 50°F (10°C) or above; the temperature has not been below 35°F (2°C) for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the RPR.

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

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

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

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

The distributor shall be equipped with a hand sprayer.

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

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

603-3.3 APPLICATION OF EMULSIFIED ASPHALT MATERIAL. The emulsified asphalt shall not be diluted. Immediately before applying the emulsified asphalt tack coat, the full width of surface to be treated shall be swept with a power broom and/or power blower to remove all loose dirt and other objectionable material.

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

Emulsified Asphalt

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

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

603-3.4 FREIGHT AND WAYBILLS. The Contractor shall submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

603-4.1 The emulsified asphalt material for tack coat shall be measured by the ton. 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 ton 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:

Bid Item No. 22 Emulsified Asphalt Tack Coat – 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 D1250	Standard Guide for Use of the Petroleum Measurement Tables
ASTM D2995	Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors
ASTM D3628	Standard Practice for Selection and Use of Emulsified Asphalts

END ITEM P-603

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 D6690.

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% ± 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.

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. Provide a routing tool, used for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

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

c. Sandblasting equipment. Sandblasting is not allowed.

d. 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.

e. Hot-poured sealing equipment. The unit applicators used for heating and installing ASTM D6690 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

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 RPR, 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 tractor-mounted routing equipment, concrete saw 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 RPR 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 1/8 inch ±1/16 inch (2 mm) 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 RPR. 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 be measured by the linear foot of sealant in place, completed, and accepted.

BASIS OF PAYMENT

605-5.1 Payment for joint sealing material shall be made at the contract unit price per linear foot. The price shall be full compensation for furnishing all materials, for all preparation, delivering, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Bid Item No. A-20	P-605 Joint Sealing Filler - 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.

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
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt
ASTM D7116	Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types for Portland Cement Concrete Pavements

Advisory Circulars (AC)

AC 150/5340-30	Design and Installation Details for Airport Visual Aids

END ITEM P-605

ITEM P-608 EMULSIFIED ASPHALT SEAL COAT

DESCRIPTION

608-1.1 This item shall consist of the application of a emulsified asphalt surface treatment composed of an emulsion of natural and refined asphalt materials, water and a polymer additive, for taxiways and runways with the application of a suitable aggregate to maintain adequate surface friction; and airfield secondary and tertiary pavements including low-speed taxiways, shoulders, overruns, roads, parking areas, and other general applications with or without aggregate applied as designated on the plans. The terms seal coat, asphalt sealer, and asphalt material are interchangeable throughout this specification. The term emulsified asphalt means an emulsion of natural and refined asphalt materials.

MATERIALS

608-2.1 AGGREGATE. The aggregate material shall be a dry, clean, dust and dirt free, sound, durable, angular shaped manufactured specialty sand, such as that used as an abrasive, with a Mohs hardness of 6 to 8. The Contractor shall submit the specialty sand manufacturer's technical data and a manufacturer's Certificate of Analysis (COA) indicating that the specialty sand meets the requirements of the specification to the RPR prior to start of construction. The sand must be approved for use by the RPR and shall meet the following gradation limits when tested in accordance with ASTM C136 and ASTM C117:

Aggregate Material Gradation Requirements[1]

Sieve Designation (square openings)	Individual Percentage Retained by Weight
No. 10 (2.00 mm)	0
No. 14 (1.41 mm)	0-4
No. 16 (1.18 mm)	0-8
No. 20 (850 µm)	0-35
No. 30 (600 µm)	20-50
No. 40 (425 µm)	10-45
No. 50 (300 µm)	0-20
No. 70 (212 µm)	0-5
No. 100 (150 µm)	0-2
No. 200 (75 µm)	0-2

[1] Locally available sand or abrasive material that is slightly outside of the gradation requirements may be approved by the RPR with concurrence by the seal coat manufacturer for the use of locally available sand or abrasive material. The RPR and manufacturer's field representative should verify acceptance during application of Control strips indicated under paragraph 608-3.2.

The Contractor shall provide a certification showing particle size analysis and properties of the material delivered for use on the project. The Contractor's certification may be subject to verification by testing the material delivered for use on the project.

608-2.2 ASPHALT EMULSION. The asphalt emulsion shall meet the properties in the following table:

Concentrated Asphalt Emulsion Properties

Properties	Specification	Limits
Viscosity, Saybolt Furol at 77°F (25°C)	ASTM D7496	20 – 100 seconds
Residue by Distillation or Evaporation	ASTM D6997 or ASTM D6934	57% minimum
Sieve Test	ASTM D6933	0.1% maximum
24-hour Stability	ASTM D6930	1% maximum
5-day Settlement Test	ASTM D6930	5.0% maximum
Particle Charge [1]	ASTM D7402	Positive 6.5 maximum pH

[1] pH may be used in lieu of the particle charge test which is sometimes inconclusive in slow setting, asphalt emulsions.

The asphalt material base residue shall contain not less than 20% gilsonite, or uintaite and shall not contain any tall oil pitch or coal tar material and shall contain no less than one percent (1%) polymer.

Tests on Residue from Distillation or Evaporation

Properties	Specification	Limits
Viscosity at 275°F (135°C)	ASTM D4402	1750 cts maximum
Solubility in 1, 1, 1 trichloroethylene	ASTM D2042	97.5% minimum
Penetration	ASTM D5	50 dmm maximum
Asphaltenes	ASTM D2007	15% minimum
Saturates	ASTM D2007	15% maximum
Polar Compounds	ASTM D2007	25% minimum
Aromatics	ASTM D2007	15% minimum

The asphalt emulsion, when diluted in the volumetric proportion of two parts concentrated asphalt material to one part hot water shall have the following properties: **Two-to-One Dilution Emulsion Properties**

Properties	Specification	Limits
In Ready-to-Apply Form, two parts concentrate to one part water, by volume		
Viscosity, Saybolt Furol at 77°F (25°C)	ASTM D7496	5 – 50 seconds
Residue by Distillation or Evaporation	ASTM D6997 or ASTM D6934	38% minimum
Pumping Stability [1]		Pass

[1] Pumping stability is tested by pumping one pint (475 ml) of seal coat diluted one (1) part concentrate to one (1) part water, at 77°F (25°C), through a 1/4-inch (6 mm) gear pump operating 1750 rpm for 10 minutes with no significant separation or coagulation.

The Contractor shall provide a copy of the manufacturer's Certificate of Analysis (COA) for the emulsified asphalt delivered to the project. If the asphalt emulsion is diluted at other than the manufacturer's facility, the Contractor shall provide a supplemental COA from an independent laboratory verifying the asphalt emulsion properties.

The COA shall be provided to and approved by the RPR before the emulsified asphalt is applied. The furnishing of the vendor's certified test report 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.

The asphalt material storage and handling temperature shall be between 50°F - 160°F (10°C - 70°C) and the material shall be protected from freezing, or whenever outside temperature drops below 40°F (4°C) for prolonged time periods.

Contractor shall provide a list of airport pavement projects, exposed to similar climate conditions, where this product has been successfully applied within at least 5 years of the project.

608-2.3 WATER. Water used in mixing or curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602 prior to use. Water used in making and diluting the emulsion shall be potable, with a maximum hardness of 90ppm calcium and 15ppm magnesium; deleterious iron, sulfates, and phosphates maximum 7ppm, and less than 1ppm of organic byproducts. Water shall be a minimum of 140°F (60°C) prior to adding to emulsion.

608-2.4 POLYMER. The polymer shall meet the properties in the following table:

Polymer Properties

Properties	Limits
Solids Content	47% to 65%, Percent by Weight
Weight	8.0 to 9.0 pounds/gallon (1.07 to 1.17 kg/L)
pH	3.0 to 8.0
Particle Charge	Nonionic/Cationic
Mechanical Stability	Excellent
Film Forming Temperature, °C	+5°C, minimum
Tg, °C	22°C, maximum

The manufacturer shall provide a copy of the Certificate of Analysis (COA) for the polymer used in the seal coat; and the Contractor shall include the COA with the emulsified asphalt COA when submitting to the RPR.

608-2.5 SEAL COAT WITH AGGREGATE. The Contractor shall submit friction test data from no less than one of the airport projects identified under 608-2.2. The test data must be from the same project and include technical details on application rates, aggregate rates, and point of contact at the airport to confirm use and success of sealer with aggregate.

Friction test data in accordance with AC 150/5320-12, at 40 or 60 mph (65 or 95 km/h) wet, must include as a minimum; the friction value prior to sealant application; two values, between 24 and 96 hours after application, with a minimum of 24 hours between tests; and one value between 180 days and 360 days after the application. The results of the tests between 24 and 96 hours shall indicate friction is increasing at a rate to obtain similar friction value of the pavement surface prior to application, and the long-term test shall indicate no apparent adverse effect with time relative to friction values and existing pavement surface.

Seal coat material submittal without required friction performance will not be approved. Friction tests performed on this project cannot be used as a substitute of this requirement.

COMPOSITION AND APPLICATION RATE

608-3.1 APPLICATION RATE. The approximate amounts of materials per square yard (square meter) for the asphalt surface treatment shall be as provided in the table for the treatment area(s) at the specified dilution rate(s) as noted on the plans. The actual application rates will vary within the range specified to suit field conditions and will be recommended by the manufacturer's representative and approved by the RPR from the test area/sections evaluation.

Application Rate

Dilution Rate	Quantity of Emulsion gal/yd^2	Quantity of Aggregate lb/yd^2
2:1	0.08-0.17	0.20-0.50

608-3.2 CONTROL AREAS AND CONTROL STRIPS. Prior to full application, the control strip must be accepted by the RPR. The surface preparation, personnel, equipment, and method of operation used on the test area(s) and control strip(s) shall be the same as used on the remainder of the work.

A qualified manufacturer's representative shall be present in the field to assist the Contractor in applying control areas and/or control strips to determine the appropriate application rate of both emulsion and aggregate to be approved by the RPR.

A test area(s) and control strip(s) shall be applied for each differing asphalt pavement surface identified in the project. The test area(s) and control strip(s) shall be used to determine the material application rate(s) of both emulsion and sand prior to full production.

a. For taxiway, taxilane and apron surfaces. Prior to full application, the Contractor shall place test areas at varying application rates as recommended by the Contractor's manufacturer's representative to determine appropriate application rate(s). The test areas will be located on representative section(s) of the pavement to receive the asphalt surface treatment designated by the RPR.

b. For runway and high-speed exit taxiway surfaces. Prior to full application, the Contractor shall place a series of control strips a minimum of 300 feet (90 m) long by 12 feet (3.6 m) wide, or width of anticipated application, whichever is greater, at varying application rates as recommended by the manufacturer's representative and acceptable to the RPR to determine appropriate application rate(s). The control strips should be separated by a minimum of 200 feet between control strips. The area to be tested will be located on a representative section of the pavement to receive the asphalt surface treatment designated by the RPR. The control strips should be placed under similar field conditions as anticipated for the actual application. The skid resistance of the existing pavement shall be determined for each control strip with a continuous friction measuring equipment (CFME). The skid resistance of existing pavement can be immediately adjacent to the control strip or at the same location as the control strip if testing prior to application. The Contractor may begin testing the skid resistance of runway and high-speed exit taxiway control strips after application of the asphalt surface treatment has fully cured, generally 8 to 36 hours after application of the control strips depending on site and environmental conditions. Aircraft shall not be permitted on the runway or high speed exit taxiway control strips until such time as the Contractor validates that its surface friction meets the maintenance planning friction levels in AC 150/5320-12, Table 3-2 when tested at speeds of 40 and 60 mph (65 and 95 km/h) wet with approved CFME.

If the control strip should prove to be unsatisfactory, necessary adjustments to the application rate, placement operations, and equipment shall be made. Additional control strips shall be placed and additional skid resistance tests performed and evaluated. Full production shall not begin without the RPR's approval of an appropriate application rate(s). Acceptable control strips shall be paid for in accordance with paragraph 608-8.1.

CONSTRUCTION METHODS

608-4.1 WORKER SAFETY. The Contractor shall obtain a Safety Data Sheet (SDS) for both the asphalt emulsion product and sand and require workmen to follow the manufacturer's recommended safety precautions.

608-4.2 WEATHER LIMITATIONS. The asphalt emulsion shall be applied only when the existing pavement surface is dry and when the weather is not foggy, rainy, or when the wind velocity will prevent the uniform application of the material. No material shall be applied in strong winds that interfere with the uniform application of the material(s), or when dust or sand is blowing or when rain is anticipated within eight (8) hours of application completion. The atmospheric temperature and the pavement surface temperature shall both be at, or above 60°F (16°C) and rising. Seal coat shall not be applied when pavement temperatures are expected to exceed 130ºF within the subsequent 72 hours if traffic will be opened on pavement within those 72 hours. During application, account for wind drift. Cover existing buildings, structures, runway edge lights, taxiway edge lights, informational signs, retro-reflective marking and in-pavement duct markers as necessary to protect against overspray before applying the emulsion. Should emulsion get on any light or marker fixture, promptly clean the fixture. If cleaning is not satisfactory to the RPR, the Contractor shall replace any light, sign or marker with equivalent equipment at no cost to the Owner.

608-4.3 EQUIPMENT AND TOOLS. The Contractor shall furnish all equipment, tools, and machinery necessary for the performance of the work.

a. Pressure distributor. 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 hundred (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. The Contractor will provide verification of truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application per nozzle manufacturer, spray-bar height and pressure and pump speed appropriate for the viscosity and temperature of sealer material, 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 12-foot (3.7-m), minimum, spray bar with individual nozzle control. The distributor truck shall be capable of specific application rates in the range of 0.05 to 0.25 gallons per square yard (0.15 to 0.80 liters per square meter). These rates shall be computer-controlled rather than mechanical. 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.

The distributor truck shall effectively heat and mix the material to the required temperature prior to application in accordance with the manufacturer's recommendations.

The distributor shall be equipped with a hand sprayer to spray the emulsion in areas not accessible to the distributor truck.

b. Aggregate spreader. The asphalt distributor truck will be equipped with an aggregate spreader mounted to the distributor truck that can apply sand to the emulsion in a single pass operation without driving through wet emulsion. The aggregate spreader shall be equipped with a variable control system capable of uniformly distributing the sand at the specified rate at varying application widths and speeds. The aggregate spreader must be adjusted to produce an even and accurate application of specified aggregate. Prior to any seal coat application, the aggregate spreader will be calibrated onsite to ensure acceptable uniformity of spread. The RPR will observe the calibration and verify the results. The aggregate spreader will be re-calibrated each time the aggregate rate is changed either during the application of test strips or production. The Contractor may consult the seal coat manufacturer representative for procedure and guidance. The sander shall have a minimum hopper capacity of 3,000 pounds (1361 kg) of sand. Push-type hand sanders will be allowed for use around lights, signs and other obstructions, if necessary.

c. Power broom/blower. A power broom and/or blower shall be provided for removing loose material from the surface to be treated.

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

608-4.4 PREPARATION OF ASPHALT PAVEMENT SURFACES. Clean pavement surface immediately prior to placing the seal coat so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film. Remove oil or grease from the asphalt pavement by scrubbing with a detergent, washing thoroughly with clean water, and then treat these areas with a spot primer. Any additional surface preparation, such as crack repair, shall be in accordance with Item P-101, paragraph 101-3.6.

a. New asphalt pavement surfaces. Allow new asphalt pavement surfaces to cure so that there is no concentration of oils on the surface.

Perform a water-break-free test to confirm that the surface oils have degraded and dissipated. (Cast approximately one gallon (4 liters) of clean water out over the surface. The water should sheet out and wet the surface uniformly without crawling or showing oil rings.) If signs of crawling or oil rings are apparent on the pavement surface, additional time must be allowed for additional curing and retesting of the pavement surface prior to treatment.

608-4.5 EMULSION MIXING. The application emulsion shall be obtained by blending asphalt material concentrate, water and polymer, if specified. Always add heated water to the asphalt material concentrate, never add asphalt material concentrate to heated water. Mix one part heated water to two parts asphalt material concentrate, by volume.

Add 1% polymer, by volume, to the emulsion mix. If the polymer is added to the emulsion mix at the plant, submit weight scale tickets to the RPR. As an option, the polymer may be added to the emulsion mix at the job site provided the polymer is added slowly while the asphalt distributor truck circulating pump is running. The mix must be agitated for a minimum of 15 minutes or until the polymer is mixed to the satisfaction of the RPR.

608-4.6 APPLICATION OF ASPHALT EMULSION. The asphalt emulsion shall be applied using a pressure distributor upon the properly prepared, clean and dry surface at the application rate recommended by the manufacturer's representative and approved by the RPR from the test area/sections evaluation for each designated treatment area. The asphalt emulsion should be applied at a temperature between 130°F (54°C) and 160°F (70°C) or in accordance with the manufacturer's recommendation.

If low spots and depressions greater than 1/2 inch (12 mm) in depth in the pavement surface cause ponding or puddling of the applied materials, the pavement surface shall be lightly broomed with a broom or brush type squeegee until the pavement surface is free of any pools of excess material.

During all applications, the surfaces of adjacent structures shall be protected to prevent their being spattered or marred.

608-4.7 APPLICATION OF AGGREGATE MATERIAL. Immediately following the application of the asphalt emulsion, friction sand at the rate recommended by the manufacturer's representative and approved by the RPR from the test area/sections evaluation for each designated application area, shall be spread uniformly over the asphalt emulsion in a single-pass operation simultaneous with the sealer application. The aggregate shall be spread to the same width of application as the asphalt material and shall not be applied in such thickness as to cause blanketing.

Sprinkling of additional aggregate material, and spraying additional asphalt material over areas that show up having insufficient cover or bitumen, shall be done by hand whenever necessary. In areas where hand work is necessitated, the sand shall be applied before the sealant begins to break.

Minimize aggregate from being broadcast and accumulating on the untreated pavement adjacent to an application pass. Prior to the next application pass, the Contractor shall clean areas of excess or loose aggregate and remove from project site.

QUALITY CONTROL (QC)

608-5.1 MANUFACTURER'S REPRESENTATION. The manufacturer's representative knowledgeable of the material, procedures, and equipment described in the specification is responsible to assist the Contractor and RPR in determining the appropriate application rates of the emulsion and aggregate, as well as recommendations for proper preparation and start-up of seal coat application. Documentation of the manufacturer representative's experience and knowledge for applying the seal coat product shall be furnished to the RPR a minimum of 10 work days prior to placement of the control strips. The cost of the manufacturer's representative shall be included in the Contractor's bid price.

608-5.2 CONTRACTOR QUALIFICATIONS. The Contractor shall provide documentation to the RPR that the seal coat Contractor is qualified to apply the seal coat, including personnel, and equipment, and has made at least three (3) applications similar to this project in the past two (2) years.

MATERIAL ACCEPTANCE

608-6.1 APPLICATION RATE. The rate of application of the asphalt emulsion shall be verified at least twice per day.

608-6.2 FRICTION TESTS. Friction tests in accordance with AC 150/5320-12, Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces, shall be performed on all runway and high-speed taxiways that received a seal coat. Each test includes performing friction tests at 40 mph and 60 mph (65 or 95 km/h) both wet, 15 feet (4.5 m) to each side of runway centerline with approved continuous friction measuring equipment (CFME). The Contractor shall coordinate testing with the RPR and provide the RPR a written report of friction test results. The RPR shall be present for testing.

METHOD OF MEASUREMENT

608-7.1 ASPHALT SURFACE TREATMENT. No direct measurement for asphalt surface treatment shall be made.

BASIS OF PAYMENT

608-8.1 No direct payment for asphalt surface treatment 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 C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D5	Standard Test Method for Penetration of Asphalt Materials
ASTM D244	Standard Test Methods and Practices for Emulsified Asphalts
ASTM D2007	Standard Test Method for Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method
ASTM D2042	Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene
ASTM D2995	Standard Practice for Estimating Application Rate of Bituminous Distributors

ASTM D4402 Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer

ASTM D5340 Standard Test Method for Airport Pavement Condition Index Surveys

Advisory Circulars (AC)

AC 150/5320-12 Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces

AC 150/5320-17 Airfield Pavement Surface Evaluation and Rating (PASER) Manuals

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

END OF ITEM P-608

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 Resident Project Representative (RPR) 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 RPR. 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 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 1/2 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. 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 IA or IIA.

610-2.5 CEMENTITIOUS MATERIALS. If included in the JMF, the Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below.

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 RPR.

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 RPR 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 RPR 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 RPR. 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**.**

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 conform to the requirements below**.**

Steel Reinforcement

Reinforcing Steel	**ASTM A615, ASTM A706, ASTM A775, ASTM A934**
Welded Steel Wire Fabric	**ASTM A1064, ASTM A884**

610-2.11 MATERIALS FOR CURING CONCRETE. Curing materials used shall conform to the following.

Materials for Curing

White-pigmented Liquid Membrane-Forming Compound, Type 2, Class B	**ASTM C309**

CONSTRUCTION METHODS

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

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 RPRs 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 RPR. 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 RPR. 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 85ºF (30 ºC), 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 RPR 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 RPR, 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 utilized for the Hangar Apron shall be measured by the number of square yards based on the dimensions shown on the plans of concrete complete in place and accepted.

Concrete utilized for the Hangar Transitions shall be measured by the number of linear feet based on the dimensions shown on the plans of concrete complete in place and accepted.

All other concrete utilized on the project shall be considered incidental to the respective work elements and no separate measurement shall be made.

BASIS OF PAYMENT

610-6.1 Payment for the Concrete Hangar Apron shall be made at the contract unit price by the number of square yards completed in place. This price shall be full compensation for furnishing all materials including reinforcement and embedded items and for all preparation, delivery, installation, and curing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment for the Concrete Hangar Transitions shall be made at the contract unit price by the linear feet completed in place. This price shall be full compensation for furnishing all materials including reinforcement and embedded

items and for all preparation, delivery, installation, and curing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

All other concrete shall be considered incidental and no separate payment shall be made.

Payment will be made under:

Bid Item No. A-21	P-610 Concrete, Hangar Apron - per Square Yards
Bid Item No. A-22	P-610 Concrete, Hangar Transition - 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.

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 C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
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

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 Resident Project Representative (RPR). 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 Resident Project Representative (RPR) prior to the initial application of markings. The reports can be used for material acceptance or the RPR may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the RPR upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers that are easily quantifiable for inspection by the RPR.

620-2.2 MARKING MATERIALS.

Table 1. Marking Materials

Paint[1]				**Glass Beads[2]**	
Type	Color	Fed Std. 595 Number	Application Rate Maximum*	Type	Application Rate Minimum
Waterborne, Type II	White	37925	115 ft2/gal max	III	10 lb/gal
Waterborne, Type II	Yellow	33538 or 33655	115 ft2/gal max	III	10 lb/gal
Waterborne, Type II	Black	37038	115 ft2/gal max	None	N/A
Preformed Thermoplastic	White	37925	See Section 2.2a "Preformed Thermoplastic Airport Pavement Markings" for requirements		
Preformed Thermoplastic	Black	37038	See Section 2.2a "Preformed Thermoplastic Airport Pavement Markings" for requirements		
Preformed Thermoplastic	Red	31136	See Section 2.2a "Preformed Thermoplastic Airport Pavement Markings" for requirements		

* Application rates shown in Table 1 are to be applied for both 1st and 2nd coats.

[1] See paragraph 620-2.2a

[2] See paragraph 620-2.2b

a. Paint. Paint shall be waterborne and preformed thermoplastic 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 II. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

Preformed Thermoplastic Airport Pavement Markings. Markings must be composed of ester modified resins in conjunction with aggregates, pigments, and binders that have been factory produced as a finished product. The material must be impervious to degradation by aviation fuels, motor fuels, and lubricants.

(1) The markings must be able to be applied in temperatures as low as 35°F without any special storage, preheating, or treatment of the material before application.

(a) The markings must be supplied with an integral, non-reflectorized black border.

(2) Graded glass beads.

(a) The material must contain a minimum of 30% intermixed graded glass beads by weight. The intermixed beads shall conform to Federal Specification TT-B-1325D, Type I, gradation A and Federal Specification TT-B-1325D, Type IV.

(b) The material must have factory applied coated surface beads in addition to the intermixed beads at a rate of one (1) lb (0.45 kg) (±10%) per 10 square feet (1 sq m). These factory-applied coated surface beads shall have a minimum of 90% true spheres, minimum refractive index of 1.50, and meet the following gradation.

Preformed Thermoplastic Bead Gradation

Size Gradation		Retained, %	Passing, %
U.S. Mesh	µm		
12	1700	0 - 2	98 - 100
14	1400	0 - 3.5	96.5 - 100
16	1180	2 - 25	75 - 98
18	1000	28 - 63	37 - 72
20	850	63 - 72	28 - 37
30	600	67 - 77	23 - 33
50	300	89 - 95	5 - 11
80	200	97 - 100	0 - 3

(3) Heating indicators. The material manufacturer shall provide a method to indicate that the material has achieved satisfactory adhesion and proper bead embedment during application and that the installation procedures have been followed.

(4) Pigments. Percent by weight.

(a) White:

- Titanium Dioxide, ASTM D476, type II shall be 10% minimum.

(b) Yellow and Colors:

- Titanium Dioxide, ASTM D476, type II shall be 1% minimum.
- Organic yellow, other colors, and tinting as required to meet color standard.

(5) Prohibited materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant federal regulations.

(6) Daylight directional reflectance.

(a) White: The daylight directional reflectance of the white paint shall not be less than 75% (relative to magnesium oxide), when tested in accordance with ASTM E2302.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 45% (relative to magnesium oxide), when tested in accordance with ASTM E2302. The x and y values shall be consistent with the federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

(7) Skid resistance. The surface, with properly applied and embedded surface beads, must provide a minimum resistance value of 45 BPN when tested according to ASTM E303.

(8) Thickness. The material must be supplied at a nominal thickness of 65 mil (1.7 mm).

(9) Environmental resistance. The material must be resistant to deterioration due to exposure to sunlight, water, salt, or adverse weather conditions and impervious to aviation fuels, gasoline, and oil.

(10) Retroreflectivity. The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of nighttime retroreflection when tested in accordance to ASTM E1710.

(11) Packaging. Packaging shall protect the material from environmental conditions until installation.

(12) Preformed thermoplastic airport pavement marking requirements.

(a) The markings must be a resilient thermoplastic product with uniformly distributed glass beads throughout the entire cross-sectional area. The markings must be resistant to the detrimental effects of aviation fuels, motor fuels and lubricants, hydraulic fluids, deicers, anti-icers, protective coatings, etc. Lines, legends, and symbols must be capable of being affixed to asphalt and/or Portland cement concrete pavements by the use of a large radiant heater. Colors shall be available as required.

(b) The markings must be capable of conforming to pavement contours, breaks, and faults through the action of airport traffic at normal pavement temperatures. The markings must be capable of fully conforming to grooved pavements, including pavement grooving per advisory circular (AC) 150/5320-12, current version. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastics when heated with a heat source per manufacturer's recommendation.

(c) Multicolored markings must consist of interconnected individual pieces of preformed thermoplastic pavement marking material, which through a variety of colors and patterns, make up the desired design. The individual pieces in each large marking segment (typically more than 20 feet (6 m) long) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a marking segment. Obtaining multicolored effect by overlaying materials of different colors is not acceptable due to resulting inconsistent marking thickness and inconsistent application temperature in the marking/substrate interface.

(d) The marking material must set up rapidly, permitting the access route to be re-opened to traffic after application.

(e) The marking material shall have an integral color throughout the thickness of the marking material.

b. Reflective media. Glass beads for white and yellow waterborne paint shall meet the requirements for Federal Specification TT-B-1325D Type III.

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 contaminates that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the RPR. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

Prior to the application of markings, the Contractor shall certify in writing that the surface is dry and free from dirt, grease, oil, laitance, or other foreign material that would prevent the bond of the paint to the pavement or existing markings. This certification along with a copy of the paint manufactures application requirements and surface preparation requirements must be submitted to the RPR prior to each application of markings.

a. Preparation of new pavement surfaces. The area to be painted shall be cleaned by broom, blower, water blasting, or by other methods approved by the RPR to remove all contaminants, including PCC curing compounds, minimizing damage to the pavement surface.

b. Preparation of pavement to remove existing markings. Existing pavement markings shall be removed by water blasting or by other methods approved by the RPR minimizing damage to the pavement surface. The removal area may need to be larger than the area of the markings to eliminate ghost markings. After removal of markings on asphalt pavements, apply a fog seal or seal coat to 'block out' the removal area to eliminate 'ghost' markings. See Item P-101, Section 3.3 for additional requirements.

c. Preparation of pavement markings prior to remarking. Prior to remarking existing markings, loose existing markings must be removed minimizing damage to the pavement surface, with a method approved by the RPR. After removal, the surface shall be cleaned of all residue or debris.

620-3.4 LAYOUT OF MARKINGS. The proposed markings shall be laid out in advance of the paint application.

620-3.5 APPLICATION. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the RPR. The elapsed time between placement of surface course or seal coat and applications of the paint shall be as follows:

Waiting Period for Paint and Reflective Media

Paint Type	Application	Minimum Waiting Period After Surface Treatment
Waterborne	1st Coat	3 days
Waterborne	2nd Coat, when required	28 days

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 immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment and distribution should be performed.

620-3.6 APPLICATION--PREFORMED THERMOPLASTIC AIRPORT PAVEMENT MARKINGS.

To ensure minimum single-pass application time and optimum bond in the marking/substrate interface, the materials must be applied using a variable speed self-propelled mobile heater with an effective heating width of no less than 16 feet (5 m) and a free span between supporting wheels of no less than 18 feet (5.5 m). The heater must emit thermal radiation to the marking material in such a manner that the difference in temperature of 2 inches (50 mm) wide linear segments in the direction of heater travel must be within 5% of the overall average temperature of the heated thermoplastic material as it exits the heater. The material must be able to be applied at ambient and pavement temperatures down to 35°F (2°C) without any preheating of the pavement to a specific temperature. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry, and free of debris. A non-volatile organic content (non-VOC) sealer with a maximum applied viscosity of 250 centiPoise must be applied to the pavement shortly before the markings are applied. The supplier must enclose application instructions with each box/package.

620-3.7 CONTROL STRIP. Prior to the full application of airfield markings, the Contractor shall prepare a control strip in the presence of the RPR. The Contractor shall demonstrate the surface preparation method and all striping equipment to be used on the project. The marking equipment must achieve the prescribed application rate of paint and population of glass beads (per Table 1) that are properly embedded and evenly distributed across the full width of the marking. Prior to acceptance of the control strip, markings must be evaluated during darkness to ensure a uniform appearance.

620-3.8 Retro-reflectance. Not Used

620-3.9 PROTECTION AND CLEANUP. After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the RPR. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes and regulations.

METHOD OF MEASUREMENT

620-4.1 The quantity of pavement markings to be paid for shall be measured by the number of square feet.

The quantity of bid item "Pavement Marking, White/Yellow, Two Coat" shall include both first and second coat applications in the same measurement.

No separate measurement shall be made for reflective media.

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 RPR in accordance with these specifications.

No separate payment shall be made for reflective media.

620-5.1a Payment for pavement markings, shall be made at the contract price for the number of square feet of painting.

620-5.1b Payment for preformed thermoplastic markings shall be made at the contract price for the number of square feet of preformed thermoplastic markings.

Payment will be made under:

Bid Item No. 23	Pavement Marking, White/Yellow, Two Coat – per Square Foot
Bid Item No. 24	Pavement Marking, Black, One Coat – per Square Foot
Bid Item No. 25	Pavement Marking, Thermoplastic – per Square Foot
Bid Item No. A-23	Pavement Marking, Yellow, Two Coat – per Square Foot
Bid Item No. A-24	Pavement Marking, Black, One Coat – per Square 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.

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

ITEM D-701 PIPE FOR STORM DRAINS AND CULVERTS

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts, storm drains, connections to existing pipes or structures in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below. Underground piping and components used in drainage systems for terminal and aircraft fueling ramp drainage shall be noncombustible and inert to fuel in accordance with National Fire Protection Association (NFPA) 415.

701-2.2 PIPE. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO R73	Standard Practice for Evaluation of Precast Concrete Drainage Productions
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C1479	Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
ASTM C1840	Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe
ASTM F667	Standard Specification for 3 through 24 in Corrugated Polyethylene Pipe and Fittings
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

701-2.3 CONCRETE. Not used.

701-2.4 RUBBER GASKETS. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443. Rubber gaskets for PVC pipe, polyethylene, and polypropylene pipe shall conform to the requirements of ASTM F477.

701-2.5 JOINT MORTAR. Pipe joint mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

701-2.6 JOINT FILLERS. Poured filler for joints shall conform to the requirements of ASTM D6690.

701-2.7 PLASTIC GASKETS. Not used.

701-2.8. CONTROLLED LOW-STRENGTH MATERIAL (CLSM). Controlled low-strength material shall conform to the requirements of Item P-153. When CLSM is used, all joints shall have gaskets.

701-2.9 PRECAST BOX CULVERTS. NOT USED

701-2.10 PRECAST CONCRETE PIPE. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification program.

701-2.11 Asphalt Trench Patch. Asphalt material for storm drain trench patching within areas of existing pavement, shall conform to Item P-401 Asphalt Mix Pavements Trench Patch.

CONSTRUCTION METHODS

701-3.1 EXCAVATION. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 12 inches (300 mm) on each side. The trench walls shall be approximately vertical.

The Contractor shall comply with all current Federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactorily jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch (200 mm) or 1/2 inch (12 mm) for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The excavation below grade should be filled with granular material to from a uniform foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The RPR shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

701-3.2 BEDDING. The bedding surface for the pipe shall provide a foundation of uniform density to support the pipe throughout its entire length.

a. Rigid pipe. The pipe bedding shall be constructed uniformly for the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 in when the bedding thickness is less than or equal to 6 inches, and 1-1/2 in when the bedding thickness is greater than 6 inches. Bedding shall be loosely placed uncompacted material under the middle third of the pipe prior to placement of the pipe.

b. Flexible pipe. For flexible pipe, the bed shall be roughly shaped to fit the pipe, and a bedding blanket of sand or fine granular material shall be provided as follows:

Flexible Pipe Bedding

Pipe Corrugation Depth		Minimum Bedding Depth	
inch	**mm**	**inch**	**mm**
1/2	12	1	25
1	25	2	50
2	50	3	75
2-1/2	60	3-1/2	90

c. Other pipe materials. For PVC, polyethylene, polypropylene, or fiberglass pipe, the bedding material shall consist of coarse sands and gravels with a maximum particle size of 3/4 inches (19 mm). For pipes installed under paved areas, no more than 12% of the material shall pass the No. 200 (0.075 mm) sieve. For all other areas, no more than 50% of the material shall pass the No. 200 (0.075 mm) sieve. The bedding shall have a thickness of at least 6 inches (150 mm) below the bottom of the pipe and extend up around the pipe for a depth of not less than 50% of the pipe's vertical outside diameter.

701-3.3 LAYING PIPE. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer's reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

701-3.4 JOINING PIPE. Joints shall be made with (1) cement mortar, (2) cement grout, or (3) rubber gaskets.

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

a. Concrete pipe. Concrete pipe may be either bell and spigot or tongue and groove. Pipe sections at joint shall be fully entered and the inner surfaces flush and even. Concrete pipe joints shall be sealed with butyl mastic meeting ASTM C990 or mortar when soil tight joints are required. Joints shall be thoroughly wetted before applying mortar or grout.

b. Metal pipe. Metal pipe shall be firmly joined by form-fitting bands conforming to the requirements of ASTM A760 for steel pipe and AASHTO M196 for aluminum pipe.

c. PVC, polyethylene and polypropylene pipe. Joints for PVC, Polyethylene, and Polypropylene pipe shall conform to the requirements of ASTM D3212 when leak resistant joints are required. Joints for PVC and Polyethylene pipe shall conform to the requirements of AASHTO M304 when soil tight joints are required. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M252 or ASTM M294. Fittings for polypropylene pipe shall conform to ASTM F2881, ASTM F2736, or ASTM F2764.

d. Fiberglass pipe. Joints and fittings shall be as detailed on the plans and in accordance with the manufacturers recommendations. Joints shall meet the requirements of ASTM D4161 for flexible elastomeric seals.

701-3.5 EMBEDMENT AND OVERFILL. Pipes shall be inspected before any fill material is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense.

701-3.5-1 EMBEDMENT MATERIAL REQUIREMENTS

a. Concrete Pipe. Embedment material and compaction requirements shall be in accordance with the applicable Type of Standard Installation (Type 1) per ASTM C1479 unless otherwise shown on plans. If a concrete cradle or CLSM embedment material is used, it shall conform to the plan details. If used, CLSM shall be installed in the pipe trench, between the pipe spring line and the bottom of Item P-154 material, for all pipe under existing and proposed pavements and within 7 feet of pavement edges.

b. Plastic and fiberglass Pipe. Embedment material shall meet the requirements of ASTM D3282, A-1 unless otherwise shown on plans. Embedment material shall be free of organic material, stones larger than 1.5 inches in the greatest dimension, or frozen lumps. Embedment material shall extend to 12 inches above the top of the pipe. If used, CLSM shall be installed in the pipe trench, between the pipe spring line and the bottom of Item P-154 material, for all pipe under existing and proposed pavements and within 7 feet of pavement edges.

c. Metal Pipe. Embedment material shall be granular as specified in the contract document and specifications, and shall be free of organic material, rock fragments larger than 1.5 inches in the greatest dimension and frozen lumps. As a minimum, backfill materials shall meet the requirements of ASTM D3282, A-1, A-2, or A-3. Embedment material shall extend to 12 inches above the top of the pipe. If used, CLSM shall be installed in the pipe trench, between the pipe spring line and the bottom of Item P-154 material, for all pipe under existing and proposed pavements and within 7 feet of pavement edges.

701-3.5-2 PLACEMENT OF EMBEDMENT MATERIAL. The embedment material shall be compacted in layers not exceeding 6 inches (150 mm) on each side of the pipe and shall be brought up one foot (30 cm) above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the embedment material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the embedment material shall be compacted in layers not exceeding 6 inches (150 mm) and shall be brought up evenly on each side of the pipe to one foot (30 cm) above the top of the pipe. All embedment material shall be compacted to a density required under Item P-152.

Concrete cradles and flowable fills, such as controlled low strength material (CLSM) or controlled density fill (CDF), may be used for embedment provided adequate flotation resistance can be achieved by restraints, weighing, or placement technique.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

701-3.6 OVERFILL. Pipes shall be inspected before any overfill is in place. Any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense. Evaluation of any damage to RCP shall be evaluated based on AASHTO R73.

Overfill material shall be place and compacted in layers as required to achieve compaction to at least 95 percent standard proctor per ASTM D1557. The soil shall contain no debris, organic matter, frozen material, or stones with a diameter greater than one half the thickness of the compacted layers being placed.

701-3.7 INSPECTION REQUIREMENTS

An initial post installation inspection shall be performed by the RPR no sooner than 30 days after completion of installation and final backfill. Clean or flush all lines prior to inspection.

Use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe interior. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe.

Reinforced concrete pipe shall be inspected, evaluated, and reported on in accordance with ASTM C1840, "Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe." Any issues reported shall include still photo and video documentation. The zoom ratio shall be provided for all still or video images that document any issues of concern by the inspection firm.

Flexible pipes shall be inspected for rips, tears, joint separations, soil migration, cracks, localized buckling, settlement, alignment, and deflection. Determine whether the allowable deflection has been exceeded by use of a laser profiler for internal pipe diameters of 48 inches or less, or direct measurement for internal pipe diameters greater than 48 inches. Laser profile equipment shall utilize low barrel distortion video equipment. Deflection of installed pipe shall not exceed the limits provided in the table below, as a percentage of the average inside diameter of the pipe.

Maximum Allowable Pipe Deflection

Type of Pipe	Maximum Allowable Deflection (%)
Corrugated Metal Pipe	5
Concrete Lined CMP	3
Thermoplastic Pipe	5
Fiberglass	5

If deflection readings in excess of the allowable deflection are obtained, remove the pipe with excessive deflection and replace with new pipe. Isolated areas may exceed allowable by 2.5% with concurrence of RPR. Repair or replace any pipe with cracks exhibiting displacement across the crack, bulges, creases, tears, spalls, or delaminations. The report for flexible pipe shall include as a minimum, the deflection results and final post installation inspection report. The inspection report shall include: a copy of all video taken, pipe location identification, equipment used for inspection, inspector name, deviation from design line and grade, and inspector's notes.

METHOD OF MEASUREMENT

701-4.1 The length of pipe shall be measured in linear feet (m) of pipe in place, completed, and accepted. It shall be measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. Classes, types and sizes of pipe shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipe being measured.

701-4.2 The quantity of connections to existing pipes or structures shall be the number of each connection made, completed and approved by the RPR, as indicated on the plans or as ordered by the RPR.

BASIS OF PAYMENT

701-5.0 These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, backfill, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

701-5.1 Payment will be made at the contract unit price per linear foot ~~(meter)~~ for each kind of pipe of the type and size designated.

701-5.2 Payment for accepted quantities of connections to existing pipes or structures will be made ~~for~~ at the contract unit price per each in place when completed.

Payment will be made under:

Bid Item No. 26	6-Inch HDPE Pipe – per Linear Foot
Bid Item No. 27	12-Inch HDPE Pipe – per Linear Foot
Bid Item No. 28	12-Inch Reinforced Concrete Pipe – per Linear Foot
Bid Item No. 29	Pipe Connection to Existing Structure – per Each
Bid Item No. A-25	8-Inch Ductile Iron Pipe – per Linear Foot
Bid Item No. A-26	12-Inch HDPE Pipe – per Linear Foot
Bid Item No. A-27	Storm Drain Trench, Existing Pavement, 12-Inch - 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.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M167	Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M190	Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M219	Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M243	Standard Specification for Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter

ASTM International (ASTM)

ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A761	Standard Specification for Corrugated Steel Structural Plate, Zinc Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A849	Standard Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM B745	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
ASTM C14	Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready Mixed Concrete
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C506	Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C507	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe
ASTM C655	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe

ASTM C990	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C1433	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
ASTM D1056	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3262	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Sewer Pipe
ASTM D3282	Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
ASTM D4161	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F667	Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR PR) Based on Outside Diameter
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F2435	Standard Specification for Steel Reinforced Polyethylene (PE) Corrugated Pipe
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
ASTM F2736	Standard Specification for 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F2764	Standard Specification for 30 to 60 in. (750 to 1500 mm) Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
ASTM F2881	Standard Specification for 12 to 60 in. (300 to 1500 mm) Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

National Fire Protection Association (NFPA)

NFPA 415	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways

END OF ITEM D-701

ITEM D-705 PIPE UNDERDRAINS FOR AIRPORTS

DESCRIPTION

705-1.1 This item shall consist of the construction of pipe drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

705-2.1 GENERAL. Materials shall meet the requirements shown on the plans and specified below.

705-2.2 PIPE. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements.

American Association of State Highway and Transportation Officials (AASHTO) M196

Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains

AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
ASTM F758	Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

705-2.3 JOINT MORTAR. Pipe joint mortar shall consist of one part by volume of Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

705-2.4 ELASTOMERIC SEALS. Elastomeric seals shall conform to the requirements of ASTM F477.

705-2.5 POROUS BACKFILL. Porous backfill shall be free of clay, humus, or other objectionable matter, and shall conform to the gradation in Table 1 when tested in accordance with ASTM C136.

TABLE 1. GRADATION OF POROUS BACKFILL

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

705-2.6. GRANULAR MATERIAL. Granular material used for backfilling shall conform to the requirements of ASTM D2321 for Class IA, IB, or II materials.

705-2.7. FILTER FABRIC. The filter fabric shall conform to the requirements of AASHTO M288 Class 2 or equivalent.

TABLE 2. FABRIC PROPERTIES

FABRIC PROPERTY	TEST METHOD	TEST REQUIREMENT
Grab Tensile Strength, lbs	ASTM D4632	125 min
Grab Tensile Elongation %	ASTM D4632	50 min
Burst Strength, psi	ASTM D3785	125 min
Trapezoid Tear Strength, lbs	ASTM D4533	55 min
Puncture Strength, lbs	ASTM D4833	40 min
Abrasion, lbs	ASTM D4886	15 max loss
Equivalent Opening Size	ASTM D4751	70-100
Permittivity sec^{-1}	ASTM D4491	0.80
Accelerated Weathering (UV Stability) (Strength Retained - %)	ASTM D4355 *(500 hrs exposure)	70

705-2.8. CONTROLLED LOW-STRENGTH MATERIAL (CLSM). CLSM is not used.

CONSTRUCTION METHODS

705-3.1 EQUIPMENT. All equipment required for the construction of pipe underdrains shall be on the project, in good working condition, and approved by the RPR before construction is permitted to start.

705-3.2 EXCAVATION. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but shall not be less than the external diameter of the pipe plus 6 inches (150 mm) on each side of the pipe. The trench walls shall be approximately vertical.

Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 4 inches (100 mm). The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches (150 mm) in uncompacted depth to form a uniform but yielding foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The RPR shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

Excavated material not required or acceptable for backfill shall be disposed of by the Contractor as directed by the RPR. The excavation shall not be carried below the required depth; if this occurs, the trench shall be backfilled at the Contractor's expense with material approved by the RPR and compacted to the density of the surrounding material.

The pipe bedding shall be constructed uniformly over the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 inch when the bedding thickness is less than or equal to 6 inches, and 1-1/2 inch when the bedding thickness is greater than 6 inches. Bedding shall be loosely placed, uncompacted material under the middle third of the pipe prior to placement of the pipe.

The Contractor shall do trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to Federal, state and local laws. Unless otherwise provided, the bracing,

sheathing, or shoring shall be removed by the Contractor after the backfill has reached at least 12 inches (300 mm) over the top of the pipe. The sheathing or shoring shall be pulled as the granular backfill is placed and compacted to avoid any unfilled spaces between the trench wall and the backfill material. The cost of bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid per foot (meter) for the pipe.

705-3.3 LAYING AND INSTALLING PIPE.

a. Concrete pipe. The laying of the pipe in the finished trench shall be started at the lowest point and proceed upgrade. When bell and spigot pipe is used, the bells shall be laid upgrade. If tongue and groove pipe is used, the groove end shall be laid upgrade. Holes in perforated pipe shall be placed down, unless otherwise shown on the plans. The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform. Pipe shall not be laid on frozen ground.

Pipe which is not true in alignment, or which shows any settlement after laying, shall be taken up and re-laid by the Contractor at no additional expense. Making adjustments in grade by exerting force on the barrel of the pipe with excavating equipment, by lifting and dropping the pipe, or by lifting the pipe and packing bedding material under it shall be prohibited. If the installed pipe section is not to grade, the pipe section shall be completely removed, the grade corrected, and the pipe rejoined."

b. Metal pipe. The metal pipe shall be laid with the separate sections joined firmly together with bands, with outside laps of circumferential joints pointing upgrade, and with longitudinal laps on the sides. Any metal in the pipe or bands that is not protected thoroughly by galvanizing shall be coated with a suitable asphaltum paint.

During installation, the asphalt-protected pipe shall be handled without damaging the asphalt coating. Any breaks in the bitumen or treatment of the pipe shall be refilled with the type and kind of bitumen used in coating the pipe originally.

c. PVC, fiberglass or polyethylene pipe. PVC or polyethylene pipe shall be installed in accordance with the requirements of ASTM D2321. Perforations shall meet the requirements of AASHTO M252 or AASHTO M294 Class 2, unless otherwise indicated on the plans. The pipe shall be laid accurately to line and grade. Fiberglass per ASTM D3839 Standard Guide for Underground Installation of "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe.

d. All types of pipe. The upgrade end of pipelines, not terminating in a structure, shall be plugged or capped as approved by the RPR.

Unless otherwise shown on the plans, a 4-inch (100 mm) bed of granular backfill material shall be spread in the bottom of the trench throughout the entire length under all perforated pipe underdrains.

Pipe outlets for the underdrains shall be constructed when required or shown on the plans. The pipe shall be laid with tight-fitting joints. Porous backfill is not required around or over pipe outlets for underdrains. All connections to other drainage pipes or structures shall be made as required and in a satisfactory manner. If connections are not made to other pipes or structures, the outlets shall be protected and constructed as shown on the plans.

e. Filter fabric. The filter fabric shall be installed in accordance with the manufacturer's recommendations, or in accordance with the AASHTO M288 Appendix, unless otherwise shown on the plans.

705-3.4 MORTAR. The mortar shall be of the desired consistency for caulking and filling the joints of the pipe and for making connections to other pipes or to structures. Mortar that is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted.

705-3.5 JOINTS IN CONCRETE PIPE. When open or partly open joints are required or specified, they shall be constructed as indicated on the plans. The pipe shall be laid with the ends fitted together as designed. If bell and spigot pipe is used, mortar shall be placed along the inside bottom quarter of the bell to center the following section of pipe.

The open or partly open joints shall be surrounded with granular material meeting requirements of porous backfill in Table 1 or as indicated on the plans. This backfill shall be placed so its thickness will be not less than 3 inches (75 mm) nor more than 6 inches (150 mm), unless otherwise shown on the plans.

705-3.6 EMBEDMENT AND BACKFILL.

a. Earth. All trenches and excavations shall be backfilled soon after the pipes are installed, unless additional protection of the pipe is directed. The embedment material shall be select material from excavation or borrow and shall be approved by the RPR. The select material shall be placed on each side of the pipe out to a distance of the nominal pipe diameter and one foot (30 cm) over the top of the pipe and shall be readily compacted. It shall not contain stones 3 inches (75 mm) or larger in size, frozen lumps, chunks of highly plastic clay, or any other material that is objectionable to the RPR. The material shall be moistened or dried, as required to aid compaction. Placement of the embedment material shall not cause displacement of the pipe. Thorough compaction under the haunches and along the sides to the top of the pipe shall be obtained.

The embedment material shall be placed in loose layers not exceeding 6 inches (150 mm) in depth under and around the pipe. Backfill material over the pipe shall be placed in lifts not exceeding 8 inches (200 mm). Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the RPR, until the trench is completely filled and brought to the planned elevation. Embedment and backfilling shall be done to avoid damaging top or side of the pipe.

In embankments and other unpaved areas, the backfill shall be compacted per Item P-152 to the density required for embankments in unpaved areas. Under paved areas, the subgrade and any backfill shall be compacted per Item P-152 to the density required for embankments for paved areas.

b. Granular backfill. When granular backfill is required, placement in the trench and about the pipe shall be as shown on the plans. The granular backfill shall not contain an excessive amount of foreign matter, nor shall soil from the sides of the trench or from the soil excavated from the trench be allowed to filter into the granular backfill. When required by the RPR, a template shall be used to properly place and separate the two sizes of backfill. The backfill shall be placed in loose layers not exceeding 6 inches (150 mm) in depth. The granular backfill shall be compacted by hand and pneumatic tampers to the requirements as given for embankment. Backfilling shall be done to avoid damaging top or side pressure on the pipe. The granular backfill shall extend to the elevation of the trench or as shown on the plans.

When perforated pipe is specified, granular backfill material shall be placed along the full length of the pipe. The position of the granular material shall be as shown on the plans.

If porous backfill is placed in paved or adjacent to paved areas before grading or subgrade operations is completed, the backfill material shall be placed immediately after laying the pipe. The depth of the granular backfill shall be not less than 12 inches (300 mm), measured from the top of the underdrain. During subsequent construction operations, a minimum depth of 12 inches (300 mm) of backfill shall be maintained over the underdrains. When the underdrains are to be completed, any unsuitable material shall be removed exposing the porous backfill. Porous backfill containing objectionable material shall be removed and replaced with suitable material. The cost of removing and replacing any unsuitable material shall be at the Contractor's expense.

If a granular subbase blanket course is used which extends several feet beyond the edge of paving to the outside edge of the underdrain trench, the granular backfill material over the underdrains shall be placed in the trench up to an elevation of 2 inches (50 mm) above the bottom surface of the granular subbase blanket course. Immediately prior to the placing of the granular subbase blanket course, the Contractor shall blade this excess trench backfill from the top of the trench onto the adjacent subgrade where it can be incorporated into the granular subbase blanket course. Any unsuitable material that remains over the underdrain trench shall be removed and replaced. The subbase material shall be placed to provide clean contact between the subbase material and the underdrain granular backfill material for the full width of the underdrain trench.

c. Controlled low-strength material (CLSM). CLSM is not used.

705-3.7 FLEXIBLE PIPE RING DEFLECTION. The flexible pipe shall be inspected by the Contractor during and after installation to ensure that the internal diameter of the pipe barrel has not been reduced by more than 5 percent. For guidance on properly sizing mandrels, refer to ASTM D3034 and ASTM F679 appendices.

705-3.8 CONNECTIONS. When the plans call for connections to existing or proposed pipe or structures, these connections shall be watertight and made to obtain a smooth uniform flow line throughout the drainage system.

705-3.9 CLEANING AND RESTORATION OF SITE. After the backfill is completed, the Contractor shall dispose of all surplus material, soil, and rubbish from the site. Surplus soil may be deposited in embankments, shoulders, or as directed by the RPR. Except for paved areas of the airport, the Contractor shall restore all disturbed areas to their original condition.

METHOD OF MEASUREMENT

705-4.1 The length of pipe shall be the number of linear feet of pipe underdrains in place, completed, and approved; measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. Different classes, types, and sizes shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipeline being measured.

704-4.2 The quantity of underdrain connection to existing pipe to be paid for shall be the number of each connection made between the underdrain system and existing storm pipe, completed and approved by the RPR, as indicated on the plans or as ordered by the RPR.

BASIS OF PAYMENT

705-5.1 Payment will be made at the contract unit price per linear foot for pipe underdrains of the type, class, and size designated. This price shall be full compensation for furnishing all materials and for all preparation, excavation, and installation of these materials, including porous backfill and filter fabric, and for all labor, equipment, tools, and incidentals necessary to complete the item.

705-5.2 Payment for underdrain connection to existing pipe will be made at the contract unit price for each connection made to the existing drainage system. This price shall be full compensation for furnishing all materials and for all preparation, excavation, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Bid Item No. 30	6-Inch Perforated HDPE Underdrain Pipe - per Linear Foot
Bid Item No. 31	Underdrain Connection to Pipe - per Each
Bid Item No. A-28	6-Inch Perforated HDPE Underdrain Pipe - per Linear Foot
Bid Item No. A-29	Underdrain Connection to Pipe - per Each

REFERENCES

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

ASTM International (ASTM)

ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C444	Standard Specification for Perforated Concrete Pipe
ASTM C654	Standard Specification for Porous Concrete Pipe
ASTM D2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D3262	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Sewer Pipe
ASTM D4161	Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F758	Standard Specification for Smooth Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M190	Standard Specification for Bituminous - Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M288	Standard Specification for Geotextile Specification for Highway Applications
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500- mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel-Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) diameter
AASHTO	Standard Specifications for Highway Bridges

END OF ITEM D-705

ITEM D-751 MANHOLES, CATCH BASINS, INLETS AND INSPECTION HOLES

DESCRIPTION

751-1.1 This item shall consist of construction of manholes, catch basins, inlets, cleanouts, drainage access structures, drainage outfall structures, and adjustment of existing drainage structures in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the RPR.

MATERIALS

751-2.1 BRICK. The brick shall conform to the requirements of ASTM C32, Grade MS.

751-2.2 MORTAR. Mortar shall consist of one part Portland cement and two parts sand. The cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

751-2.3 CONCRETE. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item P-610.

751-2.4 PRECAST CONCRETE PIPE MANHOLE RINGS. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches (90 cm) nor more than 48 inches (120 cm). There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole. Gaskets shall conform to the requirements of ASTM C443.

751-2.5 CORRUGATED METAL. Corrugated metal shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M36.

751-2.6 FRAMES, COVERS, AND GRATES. The castings shall conform to one of the following requirements:

a. ASTM A48, Class 35B: Gray iron castings

b. ASTM A47: Malleable iron castings

c. ASTM A27: Steel castings

d. ASTM A283, Grade D: Structural steel for grates and frames

e. ASTM A536, Grade 65-45-12: Ductile iron castings

f. ASTM A897: Austempered ductile iron castings

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

751-2.7 STEPS. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of asphalt paint, when directed.

751-2.8 PRECAST STRUCTURES. Manufactured in accordance with and conforming to ASTM C913.

CONSTRUCTION METHODS

751-3.1 UNCLASSIFIED EXCAVATION.

a. The Contractor shall excavate for structures and footings to the lines and grades or elevations, shown on the plans, or as staked by the RPR. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the RPR may direct, in writing, changes in dimensions or elevations of footings necessary for a satisfactory foundation.

b. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the RPR. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. Where concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing is placed.

c. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

d. All bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage finished masonry. The cost of removal shall be included in the unit price bid for the structure.

e. After excavation is completed for each structure, the Contractor shall notify the RPR. No concrete or reinforcing steel shall be placed until the RPR has approved the depth of the excavation and the character of the foundation material.

751-3.2 BRICK STRUCTURES. NOT USED

751-3.3 CONCRETE STRUCTURES. Concrete structures which are to be cast-in-place within the project boundaries shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the RPR before the concrete is placed.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped downward to the outlet.

751-3.4 PRECAST CONCRETE STRUCTURES. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program.

Precast concrete structure shall conform to ASTM C478. Precast concrete structures shall be constructed on prepared or previously placed slab foundations conforming to the dimensions and locations shown on the plans. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall: (1) be smoothed to a uniform surface on both interior and exterior of the structure or (2) utilize a rubber gasket per ASTM C443. The top of the upper precast concrete section shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal or metal encapsulated steps that are embedded or built into the side walls shall be aligned and placed in accordance to ASTM C478. When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 CORRUGATED METAL STRUCTURES. Corrugated metal structures shall be prefabricated. All standard or special fittings shall be furnished to provide pipe connections or branches with the correct dimensions and of sufficient length to accommodate connecting bands. The fittings shall be welded in place to the metal structures.

The top of the metal structure shall be designed so that either a concrete slab or metal collar may be attached to allow the fastening of a standard metal frame and grate or cover. Steps or ladders shall be furnished as shown on the plans. Corrugated metal structures shall be constructed on prepared foundations, conforming to the dimensions and locations as shown on the plans. When indicated, the structures shall be placed on a reinforced concrete base.

751-3.6 INLET AND OUTLET PIPES. Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections. They shall be cut off flush with the wall on the inside surface of the structure, unless otherwise directed. For concrete or brick structures, mortar shall be placed around these pipes to form a tight, neat connection.

751-3.7 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES, AND FITTINGS. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the RPR, and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are placed on previously constructed masonry, the bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface so the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed by the RPR. All units shall set firm and secure.

After the frames or fittings have been set in final position, the concrete or mortar shall be allowed to harden for seven (7) days before the grates or covers are placed and fastened down.

751-3.8 INSTALLATION OF STEPS. The steps shall be installed as indicated on the plans or as directed by the RPR. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least seven (7) days. After seven (7) days, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete structures, they shall meet the requirements of ASTM C478. The steps shall be cast into the side of the sections at the time the sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches (300 mm).

Instead of steps, prefabricated ladders may be installed. For brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. For metal structures, the ladder shall be secured by welding the top support to the structure and grouting the bottom support into drilled holes in the foundation or as directed by the RPR.

751-3.9 BACKFILLING.

a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches (200 mm) in loose depth, and compacted to the density required in Item P-152. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

b. Backfill shall not be placed against any structure until approved by the RPR. For concrete structures, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill and placing methods.

c. Backfill shall not be measured for direct payment. Performance of this work shall be considered an obligation of the Contractor covered under the contract unit price for the structure involved.

751-3.10 CLEANING AND RESTORATION OF SITE. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as

approved by the RPR. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 The quantity of catch basins, cleanouts, drainage access structures, drainage outfall structures, and adjustment of existing drainage structures shall be measured by the unit.

BASIS OF PAYMENT

751-5.1 The accepted quantities of catch basins, cleanouts, drainage access structures, drainage outfall structures, and adjustment of existing drainage structures will be paid for at the contract unit price per each in place when completed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor equipment, tools and incidentals necessary to complete the structure.

Payment will be made under:

Bid Item No. 32	Adjust Existing Drainage Structure - per Each
Bid Item No. 33	Catch Basin, H20 Loading - per Each
Bid Item No. 34	Catch Basin, 40 Kip Loading - per Each
Bid Item No. 35	Cleanout - per Each
Bid Item No. 36	Storm Drain Manhole – per Each
Bid Item No. 37	PCC Drainage Collar – per Each
Bid Item No. A-30	Adjust Existing Drainage Structure - per Each
Bid Item No. A-31	Catch Basin, H20 Loading - per Each
Bid Item No. A-32	Cleanout - per Each
Bid Item No. A-33	Drainage Outfall Structure - per Each

REFERENCES

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

ASTM International (ASTM)

ASTM A27	Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A897	Standard Specification for Austempered Ductile Iron Castings
ASTM C32	Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)

ASTM C144 Standard Specification for Aggregate for Masonry Mortar

ASTM C150 Standard Specification for Portland Cement

ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections

ASTM C913 Standard Specification for Precast Concrete Water and Wastewater Structures.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M36 Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains

END OF ITEM D-751

ITEM F-162 CHAIN-LINK FENCE

DESCRIPTION

162-1.1 This item shall consist of furnishing and erecting a chain-link fence in accordance with these specifications, the details shown on the plans, and in conformity with the lines and grades shown on the plans or established by the RPR.

MATERIALS

162-2.1 FABRIC. The fabric shall be woven with a 9-gauge galvanized steel wire in a 2-inch mesh and shall meet the requirements of ASTM A392, Class 2.

162-2.2 BARBED WIRE. Barbed wire shall be 2-strand 12-1/2 gauge aluminum-coated wire with 4-point barbs and shall conform to the requirements of Aluminum-coated barbed wire meeting ASTM A 121, Class 3, Chain-Link Fence Grade.

162-2.3 POSTS, RAILS, AND BRACES. Line posts, rails, and braces shall conform to the requirements of ASTM F1043 or ASTM F1083 as follows:

- Galvanized tubular steel pipe shall conform to the requirements of Group IA, (Schedule 40) coatings conforming to Type A, or Group IC (High Strength Pipe), External coating Type B, and internal coating Type B or D.
- Roll Formed Steel Shapes (C-Sections) shall conform to the requirements of Group IIA, and be galvanized in accordance with the requirements of ASTM F1043, Type A.
- Hot-Rolled Shapes (H Beams) shall meet the requirements of Group III, and be galvanized in accordance with the requirements of ASTM F1043, Type A.
- Aluminum Pipe shall conform to the requirements of Group IB.
- Aluminum Shapes shall conform to the requirements of Group IIB.
- Vinyl or polyester coated steel shall conform to the requirements of ASTM F1043, Paragraph 7.3, Optional Supplemental Color Coating.
- Composite posts shall conform to the strength requirements of ASTM F1043 or ASTM F1083. The strength loss of composite posts shall not exceed 10% when subjected to 3,600 hours of exposure to light and water in accordance with ASTM G152, ASTM G153, ASTM G154, and ASTM G155.
- Posts, rails, and braces furnished for use in conjunction with aluminum alloy fabric shall be aluminum alloy or composite.

Posts, rails, and braces, with the exception of galvanized steel conforming to ASTM F1043 or ASTM F1083, Group 1A, Type A, or aluminum alloy, shall demonstrate the ability to withstand testing in salt spray in accordance with ASTM B117 as follows:

- External: 1,000 hours with a maximum of 5% red rust.
- Internal: 650 hours with a maximum of 5% red rust.

The dimensions of the posts, rails, and braces shall be in accordance with Tables I through VI of Federal Specification RR-F-191/3.

162-2.4 GATES. Not Used.

162-2.5 WIRE TIES AND TENSION WIRES. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type. Tension wire shall be 7-gauge marcelled steel wire with the same coating as the fabric type and shall conform to ASTM A824.

All material shall conform to Federal Specification RR-F-191/4.

162-2.6 MISCELLANEOUS FITTINGS AND HARDWARE. Miscellaneous steel fittings and hardware for use with zinc-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A153. Barbed wire support arms shall withstand a load of 250 pounds (113 kg) applied vertically to the outermost end of the arm.

162-2.7 CONCRETE. Concrete shall have a minimum 28-day compressive strength of 3000 psi (2670 kPa).

162-2.8 MARKING. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the gauge of the wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.

162-2.9 SIGNS. When specified on the drawings, provide metal signs for vehicle gates, pedestrian gates, and security fencing as shown on the drawings. Sign size, color, type, and lettering shall be as shown on the drawings. Signs shall be permanently fixed to the gate or fence per the direction of the Owner with Stainless steel or galvanized hardware.

CONSTRUCTION METHODS

162-3.1 General. The fence shall be constructed in accordance with the details on the plans and as specified here using new materials. All work shall be performed in a workmanlike manner satisfactory to the RPR. The Contractor shall layout the fence line based on the plans. The Contractor shall span the opening below the fence with barbed wire at all locations where it is not practical to conform the fence to the general contour of the ground surface because of natural or manmade features such as drainage ditches. The new fence shall be permanently tied to the terminals of existing fences as shown on the plans. The Contractor shall stake down the woven wire fence at several points between posts as shown on the plans.

The Contractor shall arrange the work so that construction of the new fence will immediately follow the removal of existing fences. The length of unfenced section at any time shall not exceed 300 feet (90 m). The work shall progress in this manner and at the close of the working day the newly constructed fence shall be tied to the existing fence.

162-3.2 CLEARING FENCE LINE. Clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions that will interfere with proper construction of the fence. Stumps within the cleared area of the fence shall be grubbed or excavated. The bottom of the fence shall be placed a uniform distance above ground, as specified in the plans. When shown on the plans or as directed by the RPR, the existing fences which interfere with the new fence location shall be removed by the Contractor as a part of the construction work unless such removal is listed as a separate item in the bid schedule. All holes remaining after post and stump removal shall be refilled with suitable soil, gravel, or other suitable material and compacted with tampers.

The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction.

162-3.3 INSTALLING POSTS. All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the plans.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within seven (7) days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches (50 mm) larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches (300 mm). After the posts are set, the

remainder of the drilled hole shall be filled with grout, composed of one part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

162-3.4 INSTALLING TOP RAILS. The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.

162-3.5 INSTALLING BRACES. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.

162-3.6 INSTALLING FABRIC. The wire fabric shall be firmly attached to the posts and braced as shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than one inch (25 mm) or more than 4 inches (100 mm) from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used and multiple strands of barbed wire stretched to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches (150 mm) or less.

162-3.7 ELECTRICAL GROUNDS. Electrical grounds shall be constructed where a power line passes over the fence. The ground shall be installed directly below the point of crossing. The ground shall be accomplished with a copper clad rod 8 feet (2.4 m) long and a minimum of 5/8 inches (16 mm) in diameter driven vertically until the top is 6 inches (150 mm) below the ground surface. A No. 6 solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence construction. The Contractor shall comply with FAA-STD-019, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment, Paragraph 4.2.3.8, Lightning Protection for Fences and Gates, when fencing is adjacent to FAA facilities.

162-3.8 CLEANING UP. The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction. All disturbed areas shall be seeded per T-901.

METHOD OF MEASUREMENT

162-4.1 Chain-link fence will be measured for payment by the linear foot. Measurement will be along the top of the fence from center to center of end posts, excluding the length occupied by gate openings.

BASIS OF PAYMENT

162-5.1 Payment for chain-link fence will be made at the contract unit price per linear foot.

The price shall be full compensation for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Bid Item No. 48	Chain-Link Fence, 7-Foot - per Linear Foot
Bid Item No. 49	Chain-Link Fence, H-Brace – per Each

REFERENCES

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

ASTM International (ASTM)

ASTM A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491	Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A824	Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM F668	Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and other Organic Polymer Coated Steel Chain-Link Fence Fabric
ASTM F1043	Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F1183	Standard Specification for Aluminum Alloy Chain Link Fence Fabric
ASTM F1345	Standard Specification for Zinc 5% Aluminum-Mischmetal Alloy Coated Steel Chain-Link Fence Fabric
ASTM G152	Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM G155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials

Federal Specifications (FED SPEC)

FED SPEC RR-F-191/3	Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FED SPEC RR-F-191/4	Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

FAA Standard

FAA-STD-019	Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment

FAA Orders

5300.38	AIP Handbook

END OF ITEM F-162

ITEM T-901 SEEDING

DESCRIPTION

901-1.1 This item shall consist of soil preparation, seeding, fertilizer, and placement of topsoil on the areas shown on the plans or as directed by the RPR 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 RPR 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.

Contractor shall consult with local, Oregon grass seed manufacturer/supplier for determination of seed mix design and appropriate application (seeding) rate for hydraulically applied seed mulch. Seed shall be a quick growing species that will not be attractive to hazardous wildlife. Seed mix and application rate shall be submitted to the RPR prior to placement for approval.

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.)
Sodar Wheatgrass	96	85	2
Sheep Fescue	97	85	2
Idaho Fescue	97	85	1

Seeding shall be performed during the period between October 1st and February 1st inclusive, unless otherwise approved by the RPR.

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.

Contractor shall consult with local, Oregon grass seed manufacturer/supplier for determination of fertilizer type and appropriate application rate.

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 RPR before being placed.

901-2.6 BONDED FIBER MATRIX (BFM). A BFM shall be applied at 2,000 lbs per acre. The BFM shall be straw or wood fiber based with a 10-percent cross linked tackifier, 5-percent crimped, biodegradable interlocking fibers, and 5-percent micro-pore granules unless otherwise approved by the Engineer or RPR. BFM shall be designed to last up to 12 months in wet applications.

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. 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 RPR all sources of water at least two (2) weeks prior to use. The RPR 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 RPR 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 RPR, 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 RPR. 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 RPR. 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 acre or fraction thereof, 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:

Bid Item No. 62	Hydroseeding - 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 E-800 GENERAL ELECTRICAL PROVISIONS
AIRFIELD LIGHTING SYSTEM

DESCRIPTION

800-1.1 GENERAL. This item is intended to supplement the specifications for the Airfield Electrical, Lighting, and Lighting Control requirements of this contract.

a. It is the intent and meaning of the Drawings and Specifications that the Contractor shall provide an electrical installation that is complete, including all items and appurtenances necessary, reasonably incidental or customarily included, even though each and every item is not specifically called out or shown.

b. Installations and construction under these provisions shall be coordinated with the RPR. Specification requirements for approvals and reviews shall be coordinated with the RPR.

QUALITY ASSURANCE

800-2.1 APPLICABLE STANDARDS.

a. Codes. All electrical work shall conform to the requirements and recommendations of the latest edition of the National Electrical Code and local city and county Building and Fire Codes. In conflicts between drawings, specifications and codes, the more stringent requirements shall govern.

b. Standards. The specifications and standards of the following organizations are by reference made part of these specifications and all electrical work, unless otherwise indicated, shall comply with their requirements and recommendations wherever applicable.

Institute of Electrical and Electrical Engineers (IEEE)
American National Standards Institute (ANSI)
American Society for Testing and Materials (ASTM)
Insulated Power Cable Engineers Association (ICEA)
National Bureau of Standards (NBS)
National Electrical Contractors Association (NECA)
National Electrical Manufacturer's Association (NEMA)
National Fire Protection Association (NFPA)
Underwriter's Laboratories, Inc. (UL)
National Electrical Safety Code (NESC)

800-2.2 REQUIREMENTS OF REGULATORY AGENCIES.

a. Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20591 and shall be listed in Advisory Circular 150/5345-53 or certified under the Airport Lighting Equipment Certification Program (ALECP). All advisory circulars referenced in these specifications shall be the edition indicated or the current edition.

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.

c. The requirements and recommendations of the latest edition of the Occupational Safety and Health Act are by reference made a part of these specifications and all electrical work shall comply with their requirements and recommendations wherever applicable.

800-2.3 WORKER AND PERSONNEL REQUIREMENTS.

a. All electrical work shall be performed by workers skilled in the electrical trade and licensed for the work by the State in which the work is being performed.

b. A licensed Supervising Electrician will be required for the issuance of a building permit for constructing, installing, altering, maintaining, repairing, or replacing any electrical wiring, apparatus, or equipment on any voltage level in the jurisdiction of the Airport.

c. A licensed Journeyman Electrician is required to be on the job site whenever any electrical work is performed. Any airfield electrical work or associated electrical installations shall be accomplished under the direct supervision of a licensed Journeyman Electrician.

d. To ensure compliance with paragraph "C" above, only a documented Electrical work force with a ratio of a maximum of three Electrical Helpers for each licensed Journeyman Electrician shall be allowed to work on airfield electrical systems.

e. Contractor shall prepare documentation associated with the electrical work force confirming adherence to the requirements of paragraph "d" above. These documents shall be submitted to the RPR for approval. Also, any work force changes or revisions which affect compliance with Paragraph "d" above shall also be submitted to the RPR for approval.

f. Every airfield lighting cable splicer shall be qualified in making cable splices and terminations on cables rated above 1,000 volts A.C. The Contractor shall submit for approval, proof of the qualifications of each proposed cable splicer for the cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

g. At least thirty (30) days prior to performing any cable splicing/terminating, Contractor shall submit a written list of proposed cable splicing/terminating personnel, including written evidence the proposed personnel have had a minimum of eight (8) hours of technical training by authorized splice/termination kit manufacturer personnel. Approved training shall include a thorough review of kit components and splicing/terminating techniques and procedures.

h. In addition, each trained cable splicer shall be required to install a sample splice and a sample connector on the type and size of cable to be used under this contract. Sample connections shall be accomplished in accordance with the manufacturer's instructions.

800-2.4 EQUIPMENT, MATERIAL, AND INSTALLATION REQUIREMENTS.

a. All materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer and the best practices of the trade and to conform to the Contract Documents.

b. The Contractor shall promptly notify the RPR in writing of any conflict between any requirements of the Contract Documents and equipment manufacturer's directions and shall obtain written instructions before proceeding with the work. Should the Contractor perform any work that does not comply with the manufacturer's directions or such written instructions, they shall bear all costs arising in correcting deficiencies.

c. All equipment and materials shall be new, unless specifically noted otherwise, and shall bear the manufacturer's name, trademark and ASME, UL, and/or other labels in every case where a standard had been established for that particular item.

d. Where applicable, equipment shall be FAA approved design of a standard product of a manufacturer regularly engaged in the production of the required type of equipment, and shall be supported by a service organization reasonably convenient to the site.

e. The contractor shall furnish and install all equipment, accessories, connections, and incidental items necessary for a complete installation, ready for use and operation by the Owner.

f. It is the responsibility of the Contractor to ensure that items installed fit the space available with adequate room for proper equipment operation and maintenance. Contractor shall make field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that, in the final installation, will suit the true intent and meaning of the drawings and specification.

g. After review of equipment submittals, equipment installations may require arrangements or connections different from those shown on the drawings. It is the responsibility of the Contractor to install the equipment to operate properly. The Contractor shall provide any additional equipment and/or materials required for installations to operate in accordance with the intent of the drawings and specifications.

h. The Contractor shall be responsible for coordinating proper location of roughing in and connections by other trades. Changes associated with coordination requirements shall be made at no increase in the Contract amount or additional costs to other trades.

i. The Contractor shall support work and equipment plumb, rigid, and true to line. The Contractor shall determine how equipment, conduit, etc., are to be installed, as required by codes, drawings, and specifications. Foundations, bolts, inserts, stands, hangars, brackets, and accessories required for proper support shall be provided by the Contractor, whether or not specifically indicated on the Drawings.

800-2.5 ADDITIONAL REQUIREMENTS

a. The Contractor must ascertain that furnished components of all lighting systems, including FAA approved equipment, are compatible in all respects with each other and the remainder of the new/existing system. Consideration of power quality and control operation is required. Any non-compatible components furnished by the Contractor must be replaced by the Contractor at no additional cost to the Owner with a similar unit, approved by the RPR (different model or different manufacturer), that is compatible with the remainder of the airport lighting system. Compatibility include, but are not limited to, physical installation, electrical installation, electrical connection, maintainability, reliability, and operations.

b. In case the Contractor elects to furnish and install airport lighting equipment requiring additional wiring, transformers, adapters, mountings, etc., to those shown on the drawings and/or listed in the specifications, any cost for these items must be incidental to the equipment cost.

c. The Contractor-installed equipment (including FAA approved) must not generate any electromagnetic interference in the existing and/or new communications, weather, air navigation, and air traffic control equipment. Any equipment generating such interference must be replaced by the Contractor at no additional cost with equipment meeting the applicable specifications and not generating any interference.

d. When a specific type, style, class, etc., of FAA approved equipment is specified only that type, style, class, etc., will be acceptable, even though equipment of other types, style, class, etc., may be FAA approved.

e. Any and all instructions from the RPR to the Contractor regarding changes in, or deviations from, the plans and specifications must be in writing.

f. A minimum of three copies of the instruction book must be supplied with each different type of equipment. The books describing a more sophisticated type of equipment, such as regulators, PAPI, REIL, etc., at a minimum must contain the following:

(1) A detailed description of the overall equipment and its individual components.

(2) Theory of operation including the function of each component.

(3) Installation instructions including alignment, calibration and adjustment.

(4) Startup instructions.

(5) Preventative maintenance requirements.

(6) Chart for troubleshooting.

(7) Complete power and control detailed wiring diagram(s), showing each conductor/connection/component "black" boxes are not acceptable. The diagram or the narrative must show voltages/currents/wave shapes at strategic locations to be used when checking and/or troubleshooting the equipment. When the equipment has several brightness steps, these parameters must be indicated for all the different modes.

(8) Parts list will include all major and minor components, such as resistors, diodes, etc. It must include a complete nomenclature of each component and, if applicable, the name of its manufacturer and the catalog number.

(9) Safety instructions.

800-2.6 SUBMITTALS

a. Submit manufacturer's data or shop drawings of items giving full information as to the dimensions, materials, and other information required to define compliance with the specifications.

- All materials and equipment used to construct shall be submitted to the RPR for approval prior to ordering the equipment.
- Submittals consisting of marked catalog sheets or shop drawings shall be provided.
- Submittal data shall be presented in a clear, precise, and thorough manner.
- Original catalog sheets are preferred. Photocopies are acceptable, provided they are as good a quality as the original.
- Clearly and boldly mark each copy to identify pertinent products or models applicable to this project.
- Indicate all optional equipment and delete non-pertinent data.
- Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet.
- Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable).
- Failure to clearly identify materials on cut sheets is cause for submittal rejection.
- Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.
- Electronic submittals may be used to expedite review; however, printed submittals are required.

b. Equipment/installation diagrams shall also be submitted for approval, as required by the project specifications and/or requested. Where new or modified, L-821 & L-841 bill of materials, schematic, wiring, and layout diagrams shall be submitted. When requested, samples of these items shall be submitted for approval.

c. Contractor submittal package shall include a typewritten list indicating each bid item, with a breakdown of all item components and all parts that are assembled or associated with bid item's installation.

Submittal package list shall indicate: 1) Bid item number; 2) part numbers of associated item components, as required; and 3) reference page number where item and components information is located in the submittal package.

d. Review of submittals is done only as an aid to the Contractor and acceptance of submittals shall not relieve Contractor of responsibility for any errors or omissions in the submittals, nor shall it relieve the Contractor of total responsibility for proper and complete execution of the job. Review of submittals is not a certification or guarantee that equipment provided is compatible as required above.

CONSTRUCTION PROVISIONS

800-3.1 ELECTRICAL WORK PROVISIONS.

a. Power and Control

(1) Label all electrical equipment to identify function, circuit voltage and phase. Where the equipment contains fuses, also label the fuse or fuse link ampere rating. Where the equipment does not have sufficient area, the labeling must be done on the wall next to the unit. Labeling is subject to submittal and approval. Equipment shall have Lamacoid (engraved plastic) labels securely attached; the label text and lettering shall be readily readable and the size shall be appropriate for the equipment.

(2) Color code all phase wiring by the use of colored wire insulation and/or colored tape. Where tape is used, the wire insulation must be black. Black and red must be used for single-phase, three wire systems and black, red and blue must be used for three-phase systems. Neutral conductors, size No. 6 AWG or smaller, must be identified by a continuous white or natural outer finish. Neutral conductors larger than no. 6 AWG must be identified either by a continuous white or natural gray outer finish along its entire length or by the use of white tape at its terminations and inside accessible wireways. Equipment grounding conductors shall be green or bare copper.

(3) All branch circuit conductors connected to a particular phase must be identified with the same color. The color coding must extend to the point of utilization.

(4) In control wiring the same color must be used throughout the system for the same function, such as 10%, 30%, 100% brightness control, etc.

(5) All power and control circuit conductors must be copper; aluminum shall not be used. This includes wire, cable, busses, terminals, switch/panel components, etc.

(6) Low voltage (600 V) and high voltage (5000 V) circuits must be installed in separate conduits and wireways. Low and high-voltage conductors may occupy the same vaults or handholes if shown on the drawings or with RPR approval.

(7) Neatly lace wiring in distribution panels, wireways, switches and pull/junction boxes. Plastic wire ties are the preferred lacing method; alternate methods are subject to approval.

(8) The minimum size of pull/junction boxes, regardless of the quantity and the size of the conductors shown, must be as follows:

i. In straight pulls the length of the box must not be less than eight times the trade diameter of the larger conduit. The total area (including the conduit cross-sectional area) of a box end must be at least 3 times greater than the total trade cross-sectional area of the conduits terminating at the end.

ii. In angle or u-pulls the distance between each conduit entry inside the box and the opposite wall of the box must not be less than six times the trade diameter of the largest conduit. This distance must be increased for additional entries by the amount of the sum of the diameters of all other conduit entries on the same wall of the box. The distance between conduit entries enclosing the same conductor must of not be less than six times the trade diameter of the largest conduit.

(9) A run of conduit between terminations at equipment enclosures, square ducts and pull/junction boxes, must not contain more than the equivalent of four quarter bends (360 degrees total), including those bends located immediately at the terminations. Cast, conduit type outlets shall not be treated as pull/junction boxes.

(10) Equipment cabinets shall not be used as pull/junction boxes; only wiring terminating at the equipment shall be brought into these enclosures.

(11) Splices and junction points shall be permitted only in junction boxes, wireways equipped with removable covers, and at easily accessible locations.

(12) Branch and equipment circuit breakers in power distribution panel(s) shall be thermal-magnetic, molded case, permanent trip with 100-ampere, minimum, frame, rated for the available fault current.

(13) Dual lugs must be used where two wires, size no. 6 or larger, are to be connected to the same terminal.

(14) All wall mounted equipment enclosures must be mounted on “Unistrut”, “Superstrut”, “Kindorf”, or wooden mounting boards or as approved by RPR.

(15) Wooden equipment mounting boards must be plywood, exterior type, 3/4 inch nominal thickness, both sides painted with one coat of primer and two coats of gray, oil-based paint.

(16) Rigid steel conduit must be used throughout the installation, where subject to damage, unless otherwise specified. EMT may be used for interior installations. Flexible metal conduit (FMC) and flexible metal waterproof conduit (LFMC) shall be used where flexible connections are required. LFMC subject to outdoor conditions shall be CPE or TPU-coated; LFMC used indoors may be PVC-coated. The minimum trade size must be 3/4 inch. Conduit used outdoors must be rated for said use.

(17) All conduit must be terminated at constant current regulators with a section (10 inch minimum) of flexible conduit.

(18) Unless otherwise shown all exposed conduits must be run parallel to, or at right angles with, the lines of the structure.

(19) All steel conduits, fittings, nuts, bolts, etc., must be galvanized. EMT fittings shall be compression, set screw shall not be used.

(20) Use conduit bushings at each conduit termination. Where No. 4 AWG or larger ungrounded wire is installed, use insulated bushings.

(21) Use double lock nuts, one each side of enclosure wall, at each rigid conduit termination.

(22) Medium voltage conductor terminations shall be manufactured for that purpose.

(23) Unless otherwise noted, all indoor single conductor control wiring must be No. 12 AWG, 600V.

(24) Both ends of each control conductor must be terminated at a terminal block. The terminal block must be of proper rating and size for the function intended and they must be located in equipment enclosures or special terminal cabinets.

(25) All control conductor terminators must be of the open-eye connector/screw type. Soldered, closed-eyed terminators, or terminators without connectors are not acceptable. Ferrules must be used where stranded control wires are placed in screw-compression terminal blocks.

(26) In terminal block cabinets the minimum spacing between parallel terminal blocks must be 6 inches. The minimum spacing between terminal block sides/ends and cabinet sides/bottom/top must be 5 inches. The minimum spacing will be increased as required by the number of conductors. Additional spacing must be provided at conductor entrances.

(27) Both ends of all control conductors must be identified as to the circuit, terminal, block, and terminal number. Conductor and cable labels shall be thermal-transfer pre-printed shrink-type sleeve. The use of continuously-numbered conductors where such numbers match wiring diagrams may be an accepted alternate upon approval of the RPR.

(28) A separate and continuous neutral conductor must be installed and connected for each breaker circuit in the power panel(s) from the neutral bar to each power/control circuit.

(29) For all grounded circuits, a separate equipment grounding conductor shall be installed in all conduits; the conduit shall not be the sole grounding conductor.

(30) The following shall apply to L-821/841 relay/contactor panel/enclosures:

- **(a)** All components must be mounted in dust proof enclosures with vertically hinged covers.
- **(b)** The enclosures must have ample space for the circuit components, contactors, switches, control power transformers, terminal blocks, and incoming internal wiring.
- **(c)** All incoming/outgoing wiring must be terminated at terminal blocks.
- **(d)** Each terminal on terminal blocks and on circuit components must be clearly identified.
- **(e)** All control conductor terminations must be of the open-eye connector/screw type. Soldered, closed-eye connectors, or terminations without connectors are not acceptable. Ferrules must be used where stranded wires are placed in screw-compression terminal blocks.

(f) When the enclosure cover is opened, all circuit components, wiring, and terminals must be exposed and accessible without any removal of any panels, covers, etc., except those covering high voltage components.

(g) Access to, or removal of, a circuit component or terminal block will not require the removal of any other circuit component or terminal block.

(h) Each circuit component must be clearly identified indicating its corresponding number shown on the drawing and its function.

(i) A complete wiring diagram (not a schematic diagram) must be provided in each equipment cabinet. The diagram must represent each conductor by a separate line.

(j) The diagram must identify each circuit component and numbering and color of each internal conductor and terminal.

(k) All wiring must be neatly trained and laced. Wire management gutters may be used.

(l) Minimum power wire size shall be No. 12 AWG. Conductors shall be sized per NEC 75C tables.

b. Field Lighting

(1) Unless otherwise notified all underground field power multiple and series circuit conductors whether direct earth burial (DEB) or in duct/conduit must be FAA approved L-824 type. Insulation voltage and size must be as specified.

(2) No components of a primary circuit such as cable, connectors and transformers shall be brought above ground at edge lights, signs, REIL, etc.

(3) There must be no exposed power/control cables between the point where they leave the underground (DEB or L-867 bases) and where they enter the equipment (such as taxiway signs, PAPI, REIL, etc.) enclosures. These cables must be enclosed in rigid conduit or in flexible water-tight conduit with frangible coupling(s) at the grade or the housing cover, as shown in applicable details. Plastic conduits used above grade shall be rated for such exposure. LFMC shall be CPE or TPU coated.

(4) The joints of the L-823 primary connectors must be wrapped with one layer of rubber or synthetic rubber tape and one layer of plastic tape, one half lapped, extending at least 1-1/2 inches on each side of the joint. Alternate connector sealing methods may be approved by the RPR.

(5) The cable entrance into the field attached L-823 connectors must be enclosed by a heat-shrinkable tubing with continuous internal adhesive. Alternate sealing methods may be approved by the RPR.

(6) The inside diameter (ID) of the primary L-823 field attached connectors must match the cable ID to provide a watertight cable entrance.

(7) L-823 type 11, two-conductor secondary connector must be class "A" (factory molded).

(8) There must be no splices in the secondary cable(s) within the stems of a runway/taxiway edge/threshold lighting fixtures and the wireways leading to taxiway signs and PAPI/REIL equipment.

(9) Electrical insulating grease must be applied within the L-823, secondary, two conductor connectors to prevent water entrance. These connectors must not be taped.

(10) L-867 bases must be size B, 24" deep class 1 unless otherwise noted.

(11) Base-mounted frangible couplings must not have weep holes to the outside. Plugged up holes are not acceptable. It must have a 1/4" diameter minimum or equivalent opening for drainage from the space around the secondary connector into the L-867 base.

(12) The elevation of the frangible coupling groove must not exceed 1-1/2" above the edge of the cover in case of base-mounted couplings, or the top of the stake in case of stake-mounted couplings.

(13) Where the frangible coupling is not an integral part of the light fixture stem or mounting leg, a bead of silicon seal must be applied completely around the light stem or wireway at frangible coupling to provide a watertight seal.

(14) Plastic lighting fixture components, such as lamp heads, stems, frangible couplings, base covers, brackets, stakes, are not acceptable. L-867 plastic transformer housings are acceptable. The metal threaded fitting must be set in flange during casting process. Base cover bolts must be fabricated from 18-8 stainless steel.

(15) The tolerance for the height of runway/taxiway edge lights shall be ± one (1) inch. In the case of base-mounted lights, the specified lighting fixture height must be measured between the top of the base flange and the top of the lens, thus including the base cover, the frangible coupling, the stem, the lamp housing and the lens.

(16) The tolerance for the lateral spacing (light lane to runway/taxiway centerline) of runway/taxiway edge lights shall be ± one (1) inch. This also applies at intersections to lateral spacing between lights of a runway/taxiway and the intersecting runway/taxiway.

(17) Soil permitting, the L-867 bases shall not be pre-cast in concrete unless otherwise shown on the drawings or approved by the RPR.

(18) Conduit entrances into L-867 bases and other equipment, including signs, REIL, PAPI, etc., must be plugged from the inside with duct seal. Gardner Bender, RectorSeal, Ideal or as approved. This includes PAPI, REIL, and EBB entrance conduits, if included in the project. Duct seal shall be submitted for approval.

(19) Galvanized/painted equipment/component surfaces must not be damaged by drilling, filing, etc. Drain holes in metal transformer housings must be made before galvanized.

(20) Edge light numbering tags must be facing the pavement. Tags shall be as indicated on the drawings and are subject to approval. Method of attachment to the light is subject to approval.

(21) Cable/splice/duct markers must be pre-cast concrete of the size shown. Letters/numbers/arrows for the legend to be impressed into the tops of the markers must be pre-assembled and secured in the mold before the concrete is poured. Legend inscribed by hand in wet concrete shall not be accepted.

(22) All underground conduit or cable runs over 200 feet shall be identified by markers at 200 feet maximum spacing, with an additional marker at each change of direction of the cable run. Cable markers must be installed immediately above the cable.

(23) The cable and splice markers must identify the circuits which the cables belong to, such as RWY 4-22, PAPI-4, PAPI-22, etc.

(24) Locations of ends of all underground ducts must be identified by duct markers.

(25) The preferred mounting method of runway and taxiway signs is by the use of single row of legs. However, two rows will be acceptable upon approval of the RPR.

(26) All power and control cables in man/hand holes must be tagged. Use engraved plastic labels attached at both ends to the cable by the use of two plastic straps.

(a) Minimum of two tags must be provided on each cable in a man/hand hole - one at each cable entrance.

(b) Contractor shall propose and implement a color-coding scheme where each circuit shall be assigned a color and all labels for that circuit shall be fabricated using that color.

(c) Tagging is subject to submittal, review, and acceptance.

(27) Apply an oxide inhibiting, anti-seizing compound to all bolts, screws, nuts and frangible coupling threads. Compound shall be waterproof and appropriate for the materials.

(28) There shall be no splices between the isolation transformers. L-823 connectors are allowed at transformer connections only, unless otherwise shown.

(29) Unless otherwise specified, concrete used for slabs, footing, foundations, backfill around transformer housings, markers, etc., shall conform to Item P-610, Concrete for Miscellaneous Structures.

c. Grounding

(1) Ground all non-current-carrying metal parts of electrical equipment by using no. 6 AWG bare copper wire to be run inside cabinets and in conduits together with other wires. Where this is not feasible, run the exposed grounding wire parallel or at right angles to the building line and secure it at least every 24 inches and within 6 inches from bend or junction. The exposed wire may be no. 6 AWG if it is not subjected to physical abuse, otherwise No. 4 AWG must be used.

(2) All ground connections to busses, panels, etc., must be made with pressure type solderless lugs and ground clamps. Soldered or bolt and washer type connections are not acceptable. Clean all metal surfaces before making ground connections. Ground rods shall use irreversible connections.

(3) Tops of ground rods must be 10 inches below grade.

(4) The resistance to ground of the vault grounding system with the commercial power line neutral disconnected must not exceed 10 ohms.

(5) The resistance to ground of the counterpoise system, or at isolation locations, such as airport beacon, must not exceed 25 ohms

d. Existing Underground Utilities.

(1) At least forty-eight (48) hours prior to beginning any excavation within the airfield, locations of all utility lines and FAA cables in the construction area shall be identified and marked by Contractor with surveyor flags.

(2) Contractor shall use cable tracing equipment, hand digging location holes, or other approved methods, to pinpoint line locations. Excavations shall not proceed until all underground lines have been identified.

(3) Contractor shall hand excavate in areas of underground electrical lines to avoid disturbing the circuits.

(4) Repair of underground lines damaged by the Contractor shall be the sole responsibility of the Contractor.

800-3.2 TEMPORARY AND BYPASS CIRCUIT PROVISIONS. During construction, temporary or bypass wiring or cable installations may be required to maintain operation of certain equipment and/or airfield lighting circuits, as indicated in Construction Documents and/or as specified. Temporary/bypass circuit installations shall adhere to provisions indicated below.

a. General Requirements.

(1) Contractor shall review the requirements in the specifications and Construction Documents. Contractor shall determine locations, sizes, and quantities of temporary/bypass wiring and conduits required for project construction.

(2) At least 7 days prior to commencement of installation of temporary/bypass wiring, the Contractor shall submit a layout of proposed temporary/bypass conduits and circuits for review and approval, including proposed installation protection provisions.

b. Equipment and Materials.

(1) Temporary/bypass wiring shall meet the requirements of the Construction Plans and Specifications. Temporary/bypass wiring shall be identified at junction points with heat shrink, stainless steel, or brass tags.

(2) Provisions of Paragraph 100.3.1 shall be applicable to temporary/bypass wiring installation. All damage to existing circuits as a result of Contractor action or inaction shall be corrected accordingly at the Contractor's expense.

(3) Unless otherwise approved, temporary/bypass cables shall be installed in galvanized rigid conduit. Conduit shall be protected from damage by vehicles with suitable fencing, barriers, and/or adequately sized boards or timbers. The conduit shall be securely fastened to the pavement surface and not to the conduit protective barriers.

(4) Temporary/bypass circuits shall be removed immediately upon completion of construction or purpose for which the wiring was installed. Upon removal of boards or timbers fastened to the pavement surface to protect temporary/bypass circuits, the Contractor shall repair the pavement with approved materials and methods. Drainage toward pavement used for aircraft and vehicle movement areas is prohibited.

(5) Temporary/bypass cable shall be removed and discarded off the Airport by the Contractor, unless used and placed in conformance with the specifications, as a permanent installation. Underground conduits installed for temporary/bypass circuits shall be removed, unless Contractor is authorized to abandon in place.

(6) Any temporary/bypass cable removed from initial installation, shall not be reused for any Airport temporary or permanent, high-voltage installation. Cable reuse is not allowed to minimize the possibility of a damaged cable being reinstalled on an active Airport circuit.

(7) Temporary lighting for barricades shall be battery or generator powered, unless otherwise shown on the Drawings. Submit proposed method of providing required barricade lighting for approval.

800-3.3 EXISTING ELECTRICAL AND MATERIALS.

a. Remove all existing wiring and electrical equipment made unnecessary by the new installation. All materials removed remain property of the Owner unless otherwise shown on the Drawings or directed by the RPR. Coil conductors and sort materials according to type, class, and/or size. Store or dispose of materials as directed.

b. Underground circuiting shall not be abandoned in place without approval.

c. Removal and salvage of items associated with EEB shall be per Item L-109.

d. Removal of airfield electrical items shall be per Item P-110.

800-3.4 POWER SERVICE CONTINUITY.

a. Provide labor, materials, and supervision required to maintain full capacity power service continuity when connection or modifications are made to existing systems and facilities.

b. Do not interrupt service without prior consent of the Owner with a definite understanding of time and duration of outage. All outages will take place at a time for minimum disruption of facility activity.

800-3.5 AS-BUILT DRAWINGS.

a. The Contractor shall maintain a set of as-built drawings on the job site as required by the General Provisions of the Contract. Contractor shall mark on the as-built drawings all work details, alterations installed to meet site conditions and changes made by Change Notices. As-built drawings shall be kept available for inspection at all times. Copies of as-built drawings shall be provided to Owner and RPR upon project completion.

b. The Contractor shall document work performed by regularly taking digital photographs of work performed. Photos shall be provided to RPR on a regular basis.

800-3.6 TESTING AND TRAINING. The Contractor shall be responsible for scheduling, coordination, and payment of testing and training to include the following:

a. The Contractor shall provide a manufacturer's certified technician to supervise the initial startup service and calibration for the following equipment. The certified technician shall provide an approved site acceptance test for each piece of equipment that documents both testing and calibration results.

- Runway Edge Lighting
- Airfield Signage
- L-828 Regulator
- PAPI
- REIL

b. The Contractor shall also engage a manufacturer's certified technician to provide maintenance and operations training for airport personnel for the following minimum durations for each equipment. Training shall include manufacturer's recommended troubleshooting solutions.

- Approximately 2 Hours – Airfield Equipment
  - Runway Edge Lights
  - Airfield Signage
  - PAPI
- Approximately 2 Hours – Lighting Vault & Controls
  - L-821/841 Lighting Control Panel
  - L-854 pilot control radio
  - L-828 Regulator
  - Other EEB improvements

METHOD OF MEASUREMENT

800-4.1 MEASUREMENT. Works in this provision will not be measured but shall be considered subsidiary to the applicable bid item.

BASIS OF PAYMENT

800-5.1 PAYMENT. All items covered in this section will not be measured or paid directly, but will be considered subsidiary to the bid items.

END OF ITEM E-800

ITEM L-108 UNDERGROUND POWER CABLE FOR AIRPORTS

DESCRIPTION

108-1.1 This item shall consist of furnishing and/or installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, cable racking and training, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the RPR. This item shall not include the installation of duct banks or conduit, trenching and backfilling for duct banks or conduit, or furnishing or installation of cable for FAA owned/operated facilities.

EQUIPMENT AND MATERIALS

108-2.1 GENERAL.

a. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) advisory circulars (AC) shall be approved under the Airport Lighting Equipment Certification Program described in AC 150/5345-53, current version.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the RPR.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials in accordance with these specifications and acceptable to the RPR. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the RPR) and replaced with materials that comply with these specifications at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted electronically in pdf format, tabbed by specification section. The RPR reserves the right to reject any and all equipment, materials, or procedures that do not meet the system design and the standards and codes, specified in this document.

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 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 of 50 megaohms *(*1000V Megger*)* 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.

Wire for electrical circuits up to 600 volts shall comply with Specification L-824 and/or Federal Specification A-A-5944 and shall be type XHHW-2. THWN-2 may be used with RPR approval in above grade applications. Wire used in manufactured assemblies shall be per manufacturer standards.

All other conductors shall comply with FAA and National Electric Code (NEC) requirements.

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 on the plans. Where not indicated, Contractor shall install wire in compliance with NEC in consideration of reasonable voltage drop.

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 solid copper wire for counterpoise and/or No. 6 AWG stranded for grounding bond wire per ASTM B3 and ASTM B8, and shall be bare copper wire**.**

Ground rods shall be copper-clad steel unless otherwise indicated on the drawings. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than 8 feet long and 5/8 inch in diameter.

108-2.4 CABLE CONNECTIONS. In-line connections 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 upon RPR approval.

b. The field-attached plug-in splice. Unless otherwise shown on the plans, field attached plug-in splices shall be installed per Figure 3 of AC 150/5345-26, Specification for L-823 Plug and Receptacle, Cable Connectors, employing connector kits, for field attachment to single conductor cable. 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. All separable splices shall be color coded such that the series circuit is readily identifiable. The assignment of splice color to circuits shall be approved by RPR.

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. Splices made using split-bolts (or equivalent) and taped shall not be used.

e. Crimped Connections. In all the above cases, connections of cable conductors shall be made using crimp connectors utilizing a crimping tool designed to make a complete crimp before the tool can be removed. Set-screw type in-line splices may be used with copper conductors for low voltage applications with RPR approval and review of submittal. All L-823/L-824 splices and terminations shall be made in accordance with the manufacturer’s recommendations and listings.

f. Exothermic Welding. All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved irreversible equivalent, except the base can ground clamp connector shall be used for attachment to the base can. All exothermic connections shall be made in accordance with the manufacturer's recommendations and listings.

108-2.5 SPLICER QUALIFICATIONS. Every airfield lighting cable splicer shall be qualified in making airport cable splices and terminations on cables rated at or above 5,000 volts AC. The Contractor shall submit to the RPR proof of the qualifications of each proposed cable splicer for the airport cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

108-2.6 CONCRETE. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

108-2.7 FLOWABLE BACKFILL. Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

108-2.8 CABLE IDENTIFICATION TAGS. Cable identification tags shall be made from a non-corrosive material with the circuit identification embossed, stamped, engraved, or etched onto the tag. The tags shall be of the type as detailed on the plans. Contractor shall propose and implement a color-coding scheme where each circuit shall be assigned a color and all tags for that circuit shall be fabricated using that color. Tag color shall be coordinated with splice color. Tags and means of attachment ~~means~~ are subject to submittal and review.

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 RPR. The test shall be performed per this item and prior to any activity that will affect the respective circuit. The Contractor shall record the results on forms acceptable to the RPR. When the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, in the presence of the RPR. The Contractor shall record the results on forms acceptable to the RPR. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the existing circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance (O&M) Manual.

108-2.12 DETECTABLE WARNING TAPE. Plastic, detectable, American Public Works Association (APWA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend tape shall be polyethylene film with a metalized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item. Detectable warning tape for communication cables shall be orange. Detectable warning tape color code shall comply with the APWA Uniform Color Code.

CONSTRUCTION METHODS

108-3.1 GENERAL. The Contractor shall install the specified cable at the approximate locations indicated on the plans. Unless otherwise shown on the plans, all cable required to cross under pavements expected to carry aircraft loads shall be installed in concrete encased duct banks. Cable shall be run without splices, from fixture to fixture.

Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor shall be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections unless otherwise authorized in writing by the RPR or shown on the plans.

In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points shall be installed at locations shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed and on both sides of slack loops where a future connector would be installed.

Provide not less than 5 feet (1.5 m) of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at least one foot (30 cm) vertically above the top of the access structure. This requirement also applies where primary cable passes through empty light bases, junction boxes, and access structures to allow for future connections, or as designated by the RPR.

Primary airfield lighting cables installed shall have cable circuit identification tags 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 as described below. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be 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. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

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 manufacturer's minimum bend radius or NEC requirements (whichever is more restrictive) shall apply. Cable installation, handling and storage shall be per manufacturer's recommendations. During cold weather, particular attention shall be paid to the manufacturer's minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the RPR, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

Cable shall not be dragged across base can or manhole edges, pavement or earth. Pulling sleeves and sheaves shall be used pulling cable through conduits to prevent damage to both cable and conduit. 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. Applicable only where shown on the plans. Unless otherwise specified, the Contractor shall not direct bury cable or wire. If direct bury is approved, 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 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 RPR, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair 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 the requirements of Item P-152.

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 RPR. If not shown on the plans, the warning tape shall be located 6 inches 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 methods and/or materials 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 the requirements of Item P-152. Restoration shall be considered incidental to the pay item of which it is a component part.

108-3.4 CABLE MARKERS FOR DIRECT-BURIED CABLE. The location of direct buried circuits shall be marked by a concrete slab marker, 2 feet (60 cm) square and 4-6 inch 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.

The location of each underground cable connection/splice, except at lighting units, or isolation transformers, or power adapters shall be marked by a concrete marker slab installed to mark the location of the connection/splice. The Contractor shall impress the word “SPLICE” on each slab. The Contractor also shall impress additional circuit identification symbols on each slab as directed by the RPR. All cable markers and splice markers shall be painted international orange unless otherwise directed by the RPR. 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 RPR. 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 RPR.

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 contaminates 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 copper counterpoise wire shall be installed for lightning protection of the underground cables. Installation shall comply with applicable sections of the latest edition of NFPA 780 “*Standard for the Installation of Lightning Protection Systems*”.

a. Equipotential. Not used

b. Isolation. Not used

c. Common Installation requirements. When a metallic light base is used, the grounding electrode shall be bonded to the metallic light base or mounting stake with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

When a nonmetallic light base is used, the grounding electrode shall be bonded to the metallic light fixture or metallic base plate with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

Elevated lights shall be bonded to the internal ground lug provided in the light base can.

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. Where indicated on drawings, 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 RPR. Only personnel experienced in and regularly engaged in this type of work shall make these connections. With RPR review and acceptance, irreversible crimp connections may be used for connections of grounded copper wire and copper-clad ground rods.

Contractor shall demonstrate to the satisfaction of the RPR, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

a. All slag shall be removed from welds.

b. Using an exothermic weld to bond the counterpoise to a lug on a galvanized light base is not recommended unless the base has been specially modified. Consult the manufacturer's installation directions for proper methods of bonding copper wire to the light base. See AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.10 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 RPR. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the

RPR. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

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

b. Should the counterpoise or ground grid conductors be damaged or suspected of being damaged by construction activities the Contractor shall test the conductors for continuity with a low resistance ohmmeter. The conductors shall be isolated such that no parallel path exists and tested for continuity. The RPR shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

After installation, the Contractor shall test and demonstrate to the satisfaction of the RPR the following:

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

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

e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than 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 50 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 the typical ground rod does not exceed 25 ohms. Ground rod testing shall be by sample and shall not be less than 10% of all rods installed. The fall-of-potential ground impedance test, or other test approved by the Engineer, shall be utilized to verify this requirement.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the RPR. Where connecting new cable to existing cable, insulation resistance tests shall be performed on the new cable prior to connection to the existing circuit.

Correction of any defect identified above shall be per Engineer direction. The Engineer may require replacement of equipment at no cost to Owner. Correction of failed ground rod tests may include the installation of a second ground rod nearby, at no cost to the Owner.

METHOD OF MEASUREMENT

108-4.1 Trenching shall be measured by the linear feet of trench, including the excavation, backfill, and restoration, completed, measured as excavated, and accepted as satisfactory. When specified, separate measurement shall be made for trenches of various specified widths.

The cost of all excavation, backfill, dewatering and restoration regardless of the type of material encountered shall be included in the unit price bid for the work.

108-4.2 Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet installed, including ground rods and grounding connectors, 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. Cable or wire above ground, within the electrical equipment building, or not identified as a bid item, shall be considered incidental to the Miscellaneous Electrical Equipment bid item. The measurement for this item shall not include additional quantities required for slack, above ground, or within the electrical equipment building.

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 cable and equipment ground installed in duct bank or conduit, in place by the Contractor and accepted by the RPR. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

Payment will be made under:

Bid Item No. 38	No. 8 AWG, 5kV, L-824C Cable - per Linear Foot

REFERENCES

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

Advisory Circulars (AC)

AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-53	Airport Lighting Equipment Certification Program

Commercial Item Description

A-A-59544A	Cable and Wire, Electrical (Power, Fixed Installation)
A-A-55809	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

ASTM International (ASTM)

ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
ASTM D4388	Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes

Mil Spec

MIL-PRF-23586F	Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical
MIL-I-24391	Insulation Tape, Electrical, Plastic, Pressure Sensitive

National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)
NFPA-780	Standard for the Installation of Lightning Protection Systems

American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

ANSI/IEEE STD 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

Federal Aviation Administration Standard

FAA STD-019E	Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment

END OF ITEM L-108

ITEM L-109 AIRPORT TRANSFORMER VAULT AND VAULT EQUIPMENT

DESCRIPTION

109-1.1 This item shall consist of the furnishing of all vault equipment, wiring, cable, conduit and grounding systems in the existing electrical equipment building (EEB). 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 RPR.

Where indicated on the drawings, this item shall include furnishing of, constant current power regulators, electric service equipment, , and power distribution panels.

Included in this item is removal of abandoned and obsolete equipment and conductors, , labeling of conductors and cables, installation of new control cables, installation of conduits with power and control cables to make a functioning lighting control system. For this project, the meaning of vault includes the EEB and interconnecting conduits, chases, and vaults.

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 RPR.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the RPR) and replaced with materials that comply with these specifications at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the RPR for review prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted in electronic pdf format, tabbed by specification section. The RPR reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes, specified in this document.

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.

ELECTRICAL EQUIPMENT BUILDING; MISCELLANEOUS EQUIPMENT AND MATERIALS

109-3.1 ELECTRICAL VAULT BUILDING. The electrical vault building must comply with NEC Article 110.31, Enclosure for Electrical Installations, Item (A) Electrical Vaults. Construct the building of materials having adequate structural strength for the conditions and installed location, has a minimum fire rating of two or three hours as determined by the authority having jurisdiction (AHJ), and is bullet resistant to minimum UL 752 Level 4.

109-3.2 CONCRETE. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

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 RPR 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. Electrical Metallic Tubing (EMT) may be used for interior applications where not subject to physical damage. Set-screw couplings may not be used. EMT shall comply with UL514B.

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 UL listed and labeled for wet locations.

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 $\times$ 3/4 inch (3 $\times$ 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 $\times$ 4 inch (100 $\times$ 100 mm) except where otherwise shown in the plans.

109-3.14 GROUND RODS. Ground rods shall be in accordance with Item L-108. Ground wire shall be attached to ground rods using irreversible connections.

109-3.15 VAULT PREFABRICATED METAL HOUSING. The prefabricated metal housing shall be a commercially available unit.

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)

Regulators shall be as indicated on the drawings. Unless otherwise indicated, regulators shall be 240V 60Hz Class 1, Style 1. Regulators shall be ferro-resonant or saturable reactor type unless approved by Engineer.

109-3.17 OTHER ELECTRICAL EQUIPMENT. Distribution transformers, power distribution panels, automatic transfer 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 when applicable.

a. Control wiring to regulators. Unless otherwise shown on the plans, control wiring to regulators shall be incidental to control installation; power to regulators shall be incidental to regulator installation.

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, thermoset or thermoplastic wire conforming to Fed. Spec. J-C-30, Types XHHW-2, THW-2, and THWN-2 as indicated on the drawings shall be used. Thermoset wire (XHHW-2) shall be used in all damp or wet locations. Thermoplastic wire may be used as approved by the Engineer in above ground applications. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal. Where unspecified, wire shall be sized per NEC.

a. Control circuits. Unless otherwise indicated on the plans, wire for field-wired control 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 per NEC and insulated for at least 600 volts.

(2) 3,000 volts maximum – Wire shall be No. 8 AWG or larger and insulated for at least 3,000 volts.

(3) Over 3,000 volts-Wire shall be No. 8 AWG or larger and insulated for at least the circuit voltage.

109-3.19 SHORT CIRCUIT / COORDINATION / DEVICE EVALUATION / ARC FLASH ANALYSIS. Not Used

CONSTRUCTION METHODS

ELECTRICAL EQUIPMENT BUILDING; MISCELLANEOUS EQUIPMENT AND MATERIALS

109-4.1 GENERAL. The vault shall provide adequate protection against weather elements, including rain, wind-driven dust, snow, ice and excessive heat. The vault shall have sufficient filtered ventilation, to assure that the interior room temperatures and conditions do not exceed the recommended limits of the electrical equipment to be installed in the vault. The Contractor is responsible for contacting the manufacturer of the equipment to be installed to obtain environmental limitations of the equipment to be installed.

109-4.2 FOUNDATION AND WALLS. Not Used

109-4.3 ROOF. Not Used

109-4.4 FLOOR. Not Used

109-4.5 FLOOR DRAIN. Not Used

109-4.6 CONDUITS IN FLOOR AND FOUNDATION. Not Used

109-4.7 DOORS. Not Used

109-4.8 PAINTING. Not Used

109-4.9 LIGHTS AND SWITCHES. Not Used

INSTALLATION OF EQUIPMENT IN VAULT ELECTRICAL EQUIPMENT BUILDING; MISCELLANEOUS EQUIPMENT AND MATERIALS

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 optional standby 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.

Ancillary equipment such as lights, heaters, ventilation, exhaust fans, etc. shall be installed as indicated on the drawings and as required by National Electric Code. Appropriate controls shall be installed for ventilation, heater and light control. Exterior lights, where indicated, shall be controlled by photo control.

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 RPR. The power supply equipment shall be set on galvanized steel “H” sections, “I” beams, or channels to provide a minimum space of 1-1/2 inch (38 mm) between the equipment and the floor. Where indicated, galvanized steel elevating stands shall be provided. The equipment shall be placed so as not to obstruct the oil-sampling plugs of the oil-filled units; and name-plates shall not be obscured. Manufacturer recommended operating clearances and access shall be maintained.

If specified in the plans and specifications, equipment for an alternate power source or an optional standby 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 power generator set shall be the size and type specified.

Constant current regulator(s) shall be of the rating indicated on the drawing conforming to the requirements of FAA Specification L-828 and is indicated on the drawings or these specifications. Regulators shall be provided with

power circuit wiring and overcurrent protection per manufacturer recommendation, incidental to the regulator installation. Regulators shall be of ferroresonant design for low power system harmonics.

109-5.3 SWITCHGEAR AND PANELS. Switches, fuses, circuit breakers, 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 RPR. 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. Manufacturer mounting requirements shall be satisfied. Mount equipment using a commercially available strut channel framing and fittings system where indicated or required.

109-5.4 DUCT AND CONDUIT. The Contractor shall furnish and install square-type exposed metallic raceway with removable covers for the power and control circuits in the vault where indicated on the drawings. These shall be mounted along the walls behind all floor-mounted equipment and immediately below all wall-mounted equipment.

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.

To facilitate maintenance and accommodate vibration, flexible metallic conduit shall be used for connections to equipment such as constant current regulators, exhaust fans, heaters, and standby generators where applicable.

109-5.5 WIRING AND CONNECTIONS. The Contractor shall make all necessary electrical connections in the vault per the wiring diagrams furnished, in accordance with manufacturer installation manuals, and as directed by the RPR. 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 labeled and neatly laced in place; wiring gutter may be used.

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 heat-shrink wire sleeves or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks. Identification markings designated in the plans shall be followed. Engraved plastic labels, embossed durable metal tags, or other RPR approved means, secured with non-metallic ties, shall be used. Control cables shall be labeled at every accessible location.

b. Labels. The Contractor shall install engraved labels on the cases of regulators, breakers, and distribution and control relay cases as designated by the RPR. 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.

109-5.7 CABLE ENTRANCE. Incoming underground cable from field lighting circuits and supply circuits will be installed outside the walls of the transformer vault as a separate item under Item L-108. The Contractor installing the vault equipment shall bring the cables from the trench or duct through the entrance conduits into the vault and make the necessary electrical connections.

109-5.8 VAULT EQUIPMENT. Ancillary equipment such as lights, heaters, ventilation, exhaust fans, etc. shall be installed as indicated on the drawings and as required by National Electric Code. Appropriate controls shall be installed for ventilation, heater and light control. Exterior lights, where indicated, shall be controlled by photo control.

109-5.9 EEB EXISTING ELECTRICAL AND MATERIALS. Remove all existing unused components and all existing wiring and electrical equipment made unnecessary by the new installation and as noted on the drawings. All

materials shall be disposed of offsite by the Contractor unless otherwise directed by the RPR or noted for salvage in the specifications or drawings.

METHOD OF MEASUREMENT

109-6.1 The measured quantity of L-828 Regulator to be paid for under this item shall be for each item, installed connected, tested and accepted as a complete unit ready for operation.

109-6.2 The measured quantity of Miscellaneous Electrical Equipment shall be per Lump Sum, installed, connected, tested and accepted as a complete unit ready for operation.

BASIS OF PAYMENT

109-7.1 Payment will be made at the contract lump sum price for a completed and accepted miscellaneous electrical equipment. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

109-7.2 Payment will be made at the contract unit price for each completed and accepted L-828 regulator. 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:

Bid Item No. 39	Miscellaneous Electrical Building Improvements - per Lump Sum
Bid Item No. 40	L-828 6.6A, 7.5kW, 240VAC Regulator - 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 150/5340-30	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

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) Institute of Electrical and Electronic Engineers (IEEE)
IEEE 1584	Guide for Performing Arc-Flash Hazard Calculations

Master Painter's Institute (MPI)

MPI Reference #9	Alkyd, Exterior, Gloss (MPI Gloss Level 6)

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

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. This item shall include the removal of single or multiple conduits as shown on drawings; where conduits are removed, this item includes removal of the wire in the conduit. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.

EQUIPMENT AND MATERIALS

110-2.1 GENERAL.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the RPR.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the RPR. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the RPR and replaced with materials that comply with these specifications, at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be electronically submitted in pdf format, tabbed by specification section. The RPR reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes specified in this document.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least 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.

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.

EMT conduit may be used with Engineer Approval in protected above-grade locations. EMT shall use compression type connectors only, set-screw type shall not be used. Conduit support shall follow NEC requirements and shall essentially follow the standard construction practices used at the facility.

Conduit bodies, where their use is approved, shall be galvanized malleable iron. Conduit bodies shall not be used as junction or splice enclosures. Conduit bodies shall have no more than two conduit entries.

LFMC, where approved for use, shall be CPE or TPU-coated when used outdoors and may be PVC-coated when used indoors.

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, as appropriate.

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. Where reinforced duct banks are specified, reinforcing steel shall conform to ASTM A615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

110-2.7 PRECAST CONCRETE STRUCTURES. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program. Precast concrete structures shall conform to ASTM C478.

110-2.8 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. Non-Ferrous, detectable, American Public Works Association (APWA) red (electrical power lines, cables, conduit and lighting cable), orange (telephone/fiber optic cabling) with continuous legend shall be 3-6 inches (75-150 mm) wide, and subject to submittal. Detectable tape is incidental to the respective bid item. Warning tape shall be red and labeled “CAUTION: BURIED ELECTRIC LINE BELOW”

CONSTRUCTION METHODS

110-3.1 GENERAL. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The RPR shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches (50 mm) inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches (75 mm) per 100 feet (30 m). On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. Under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade; in other locations, the top of the duct bank or underground conduit shall be not less than 18 inches (0.5 m) below finished grade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch (6 mm) smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

The Contractor shall swab out all conduits/ducts and clean base can, manhole, pull boxes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed the light bases, manholes, pull boxes, etc., and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

All conduits entering hand holes, man holes, or vaults shall be terminated using an end bell glued to the end of the conduit. End bells damaged during installation or cable pulling shall be replaced.

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 spare conduits within concrete encasement of the duct banks shall terminate in the adjacent handhole, unless otherwise shown on the plans. Where terminated outside a handhole 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 ¼-inch (6.3 mm) sieve. Flowable backfill may alternatively be used

Underground electrical warning (Caution) tape shall be installed in the trench above all underground duct banks and conduits in unpaved areas. Contractor shall submit a sample of the proposed warning tape for approval by the RPR. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (60 cm).

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the RPR, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the RPR.

All excavation shall be unclassified and shall be considered incidental to Item L-110. Dewatering necessary for duct installation, and erosion per federal, state, and local requirements is incidental to Item L-110.

Unless otherwise specified, excavated materials that are deemed by the RPR to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the RPR and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

b. Trenching, etc., in cable areas shall then proceed with approval of the RPR, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

110-3.2 DUCT BANKS. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches (0.5 m) below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 inch (75 mm) apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches (75 mm) thick unless otherwise

shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot (1.5-m) intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the RPR shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the RPR.

110-3.3 CONDUITS WITHOUT CONCRETE ENCASEMENT. Trenches for single-conduit lines shall be not less than 6 inches (150 mm) nor more than 12 inches (300 mm) wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a ¼-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 lot less than 6 inches (150 mm) apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth while backfilling. For this purpose, the spacers

shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR 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 RPR, 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 RPR. 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 RPR. 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.

If approved by the RPR, flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

110-3.6 BACKFILLING FOR DUCT BANKS. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the requirements of Item P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet (76 m) of duct bank or one work period's construction, whichever is less.

If approved by the RPR, flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

110-3.7 RESTORATION. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include the methods and/or materials 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. The Contractor shall be responsible to dispose of conduit and/or cable identified for removal offsite unless otherwise directed by the RPR.

METHOD OF MEASUREMENT

110-4.1 Underground conduits and duct banks shall be measured by the linear feet (meter) of conduits and duct banks installed, including the length of duct in concrete 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.

110-4.2 Electrical Trench for underground conduit shall be measured by the linear feet for separate categories of trench as determined by the conditions in which the trenching is performed: whether in paved area or in non-paved areas. Trenching measurements shall also include excavation and backfill required to connect new conduit with existing conduit or duct banks. In either case, measurement of electrical trench shall be backfilled with designated material, measured in place, complete, and accepted. No other separate measurement shall be made for variations the number or size of conduit, or for any variations in material encountered. Trench backfill and compaction shall be included as shown on the Plans for each respective item.

110-4.3 Concrete Encasement of Duct shall be measured by the linear feet of concrete encasing the ducts, regardless of the type or number of ducts contained in the encasement . The quantity of ducts within the encasement shall be included in the measurement for each designated type and size of duct.

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.

110-5.2 Payment will be made at the contract unit price per linear foot for each separate category of electrical trench completed and accepted, including excavation and backfill with the designated material, and, for termination at the structure.

This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with the provisions and intent of the plans and specifications.

110-5.3 Concrete Encasement of Duct shall be paid at the contract unit price per linear foot of concrete encasement, regardless of the type or number of ducts contained in the encasement. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with the provisions and intent of the plans and specifications. Payment for the quantity of ducts within the encasement shall be included in the payment for each respective duct.

Payment will be made under:

Bid Item No. 41	2-Inch PVC Conduit--per Linear Foot
Bid Item No. 42	Concrete Encasement of Duct--per Linear Foot
Bid Item No. 43	Electrical Trench, Non-Paved--per Linear Foot
Bid Item No. 44	Electrical Trench, Paved Area--per Linear Foot
Bid Item No. A-34	Underground Conduit--per Linear Foot

REFERENCES

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

Advisory Circular (AC)

AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-53	Airport Lighting Equipment Certification Program

ASTM International (ASTM)

ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

National Fire Protection Association (NFPA)

NFPA-70	National Electrical Code (NEC)

Underwriters Laboratories (UL)

UL Standard 6	Electrical Rigid Metal Conduit - Steel
UL Standard 514B	Conduit, Tubing, and Cable Fittings
UL Standard 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL Standard 1242	Electrical Intermediate Metal Conduit Steel
UL Standard 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL Standard 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110

ITEM L-115 ELECTRICAL MANHOLES AND JUNCTION STRUCTURES

DESCRIPTION

115-1.1 This item shall consist of electrical manholes and junction structures (hand holes, pull boxes, junction cans, etc.) installed per this specification, at the indicated locations and conforming to the lines, grades and dimensions shown on the plans or as required by the RPR. This item shall include the installation of each electrical manhole and/or junction structures with all associated excavation, backfilling, sheeting and bracing, concrete, reinforcing steel, ladders, appurtenances, testing, dewatering and restoration of surfaces to the satisfaction of the RPR. Where removal of hand holes, vaults, or junction cans is indicated on drawings, this item shall include that work.

EQUIPMENT AND MATERIALS

115-2.1 GENERAL.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the RPR.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the RPR) and replaced with materials that comply with these specifications at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted electronically submitted in pdf format, tabbed by specification section. The RPR reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes, specified in this document.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least 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 155,000 lb aircraft loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans. Square knockouts are not acceptable.

Threaded inserts and pulling eyes shall be cast in as shown on the plans. Precast structures shall include at least two horizontal cable support mounting slots on all four interior sides.

If the Contractor chooses to propose a different structural design, signed and sealed shop drawings, design calculations, and other information requested by the RPR shall be submitted by the Contractor to allow for a full evaluation by the RPR. The RPR shall review per the process defined in the General Provisions.

115-2.4 JUNCTION CANS. Junction cans 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 not less than 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. All junction can covers shall have bolt head recesses counterbored for each bolt; additional cover thickness may be required.

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. All concrete used in structures shall conform to the requirements of 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 190 psi and maximum load of 155,000 lbs.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover unit shall be provided with fastening members to prevent it from being dislodged by traffic, but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

Each cover shall have the word “ELECTRIC” or other approved designation cast on it. Each frame and cover shall be as shown on the plans or approved equivalent. No cable notches are required.

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 as shown on the plans. 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 bell end 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 copper or copper clad steel or as indicated on the drawings**.** The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 8 feet (2.4 m) long nor less than 5/8 inch (16 mm) in diameter.

CONSTRUCTION METHODS

115-3.1 UNCLASSIFIED EXCAVATION. It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Damage to utility lines, through lack of care in excavating, shall be repaired or replaced to the satisfaction of the RPR without additional expense to the Owner.

The Contractor shall perform excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the RPR. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.

All excavation shall be unclassified and shall be considered incidental to Item L-115. Dewatering necessary for structure installation and erosion per federal, state, and local requirements is incidental to Item L-115.

Boulders, logs and all other objectionable material encountered in excavation shall be removed. All rock and other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the RPR. All seams, crevices, disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

The Contractor shall provide all bracing, sheeting and shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheeting and shoring shall be included in the unit price bid for the structure.

Unless otherwise provided, bracing, sheeting and shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner that will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

After each excavation is completed, the Contractor shall notify the RPR. Structures shall be placed after the RPR has approved the depth of the excavation and the suitability of the foundation material.

Prior to installation the Contractor shall provide a minimum of 6 inches (150 mm) of sand or a material approved by the RPR as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

115-3.2 CONCRETE STRUCTURES. Concrete structures shall be built on prepared foundations conforming to the dimensions and form indicated on the plans. The concrete and construction methods shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the RPR before the concrete is placed.

115-3.3 PRECAST UNIT INSTALLATIONS. Precast units shall be installed plumb and true. Joints shall be made watertight by use of sealant at each tongue-and-groove joint and at roof of manhole. Excess sealant shall be removed and severe surface projections on exterior of neck shall be removed.

115-3.4 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES AND FITTINGS. All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the RPR and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

Field connections shall be made with bolts, unless indicated otherwise. Welding will not be permitted unless shown otherwise on the approved shop drawings and written approval is granted by the casting manufacturer. Erection equipment shall be suitable and safe for the workman. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to the RPR and approval of the method of correction shall be obtained. Approved corrections shall be made at Contractor's expense.

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

Pulling-in irons shall be located opposite all conduit entrances into structures to provide a strong, convenient attachment for pulling-in blocks when installing cables. Pulling-in irons shall be set directly into the concrete walls of the structure.

115-3.5 INSTALLATION OF LADDERS. Ladders shall be installed such that they may be removed if necessary. Mounting brackets shall be supplied top and bottom and shall be cast in place during fabrication of the structure or drilled and grouted in place after erection of the structure.

115-3.6 REMOVAL OF SHEETING AND BRACING. In general, all sheeting and bracing used to support the sides of trenches or other open excavations shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a structure shall be withdrawn, unless otherwise directed, before more than 6 inches (150 mm) of material is placed above the top of the structure and before any bracing is removed. Voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.

The RPR may direct the Contractor to delay the removal of sheeting and bracing if, in his judgment, the installed work has not attained the necessary strength to permit placing of backfill.

115-3.7 BACKFILLING. After a structure has been completed or placed, the area around it shall be backfilled and tamped in horizontal layers not to exceed 6 inches (150 mm) in thickness measured after compaction to the density requirements in Item P-152. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

Backfill shall not be placed against any structure until approval is given by the RPR. In the case of concrete, such approval shall not be given until tests made by the laboratory under supervision of the RPR establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

Where required, the RPR may direct the Contractor to add, at his own expense, sufficient water during compaction to assure a complete consolidation of the backfill. The Contractor shall be responsible for all damage or injury done to conduits, duct banks, structures, property or persons due to improper placing or compacting of backfill.

115-3.8 CONNECTION OF DUCT BANKS. To relieve stress of joint between concrete-encased duct banks and structure walls, reinforcement rods shall be placed in the structure wall and shall be formed and tied into duct bank reinforcement at the time the duct bank is installed.

115-3.9 GROUNDING. A ground rod shall be installed in the floor of all concrete structures so that the top of rod extends 6 inches (150 mm) above the floor. The ground rod shall be installed within one foot (30 cm) of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor shall drill a 4-inch (100 mm) diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod. Where soil conditions prohibit vertical ground rod installation, alternate installations may be submitted to the RPR for consideration.

A grounding bus of #6 bare solids copper shall be irreversibly 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. 6 American wire gauge (AWG) bare copper pigtails shall bond the grounding bus to all cable trays and other metal hardware within the concrete structure. Connections to the grounding bus shall be exothermic. If an exothermic weld is not possible, connections to the grounding bus shall be made by using connectors approved for direct burial in soil or concrete per UL 467. Hardware connections may be mechanical, using a lug designed for that purpose.

115-3.10 CLEANUP AND REPAIR. After erection of all galvanized items, damaged areas shall be repaired by applying a liquid cold-galvanizing compound per MIL-P-21035. Surfaces shall be prepared and compound applied per the manufacturer's recommendations.

Prior to acceptance, the entire structure shall be cleaned of all dirt and debris.

115-3.11 RESTORATION. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. The Contractor shall restore all disturbed areas equivalent to or better than their original condition. All sodding, grading and restoration shall be considered incidental to the respective 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.

If FOD is encountered that are not created during the work, Contractor shall notify RPR of the need for additional FOD removal.

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. Alternate test methods may be proposed to the RPR. 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 RPR.

Payment will be made under:

Bid Item No. 45	Adjust Existing Electrical Structure - per Each
Bid Item No. 46	Electrical Handhole - per Each
Bid Item No. 47	Junction Can - 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 GENERAL. 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, controls, circuit breakers, materials, services, base cans, transformers, concrete foundations, specified wiring, cable connections; associated conduit and conduit fittings between master and slave unit(s); the furnishing and installation of all lamps, ground rods, and ground connection; the testing of the installation; and incidentals necessary to place the systems in operation as completed units to the satisfaction of the RPR. Trenching, backfill, conduit, and power cable to the lighting systems are considered separately under the respective specification sections associated with these items.

125-1.2 REFERENCED MATERIALS. Additional details pertaining to specific systems covered in this item are contained in the Advisory Circulars (latest edition) listed below:

150/5340-30	Design and Installation Details for Airport Visual Aids
150/5345-28	Precision Approach Path Indicator (PAPI) Systems
150/5345-39	Specification for L-853, Runway and Taxiway Retroreflective Markers
150/5345-42	Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
150/5345-44	Specification for Runway and Taxiway Signs
150/5345-46	Specification for Runway and Taxiway Light Fixtures
150/5345-47	Isolation Transformers for Airport Lighting Systems
150/5345-53	Airport Lighting Equipment Certification Program

The Contractor is responsible for using the latest edition of the referenced FAA Advisory Circulars.

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 performs as intended because of incompatibility with the system, the Contractor assumes all costs to correct the system for to operate properly.

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

c. All materials and equipment used shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be clearly made with arrows or circles (highlighting is

not acceptable). The Contractor shall be responsible for delays in the project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted electronic PDF format, tabbed by specification section. The RPR reserves the right to reject any or all equipment, materials or procedures, which, in the RPR's opinion, does not meet the system design and the standards and codes, specified herein.

e. All non-LED 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 must be warranted by the manufacturer for a minimum of 4 years after date of installation inclusive of all electronics (See AC 150/5340-26 for replacement criterion for light fixtures). The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

EQUIPMENT AND MATERIALS

125-2.2 CONDUIT/DUCT. Conduit shall conform to Specification Item L-110 Airport Underground Electrical Duct Banks and Conduits.

125-2.3 CABLE AND COUNTERPOISE. Cable and Counterpoise shall conform to Item L-108 Underground Power Cable for Airports.

125-2.4 TAPE. Rubber and plastic electrical tapes shall be Scotch Electrical Tape Numbers 23 and 88 respectively, as manufactured by 3M Company or an approved equal.

125-2.5 CABLE CONNECTIONS. Cable Connections shall conform to Item L-108 Installation of Underground Cable for Airports.

125-2.6 RETROREFLECTIVE MARKERS. Retroreflective markers shall be type L-853 and shall conform to the requirements of AC 150/5345-39.

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.

a. Runway Edge Light, Elevated. Elevated runway lights shall conform to the requirements of FAA specification(s) and the following table and as indicated on the drawings. Light type shall meet FAA requirements for location and use of each light. Base cans shall be as shown in the following table and considered part of the light unit. Contractor shall determine the size and location of hubs to connect to existing. Unused hubs shall be sealed per manufacturer's recommendations and the specifications.

Where LED lamp light level is controlled using pulse-width modulation (PWM), the frequency of PWM shall not create a strobing-effect when viewed through the propeller of an aircraft. Manufacturer shall document and submit evidence to verify that PWM-prop strobing has been investigated and addressed in the LED lamp dimming control.

b. Runway Edge Light, Flush, In-Pavement. Flush mounted in-pavement runway lights shall conform to the requirements of FAA specification(s) and the following table and as indicated on the drawings. Light type shall meet FAA requirements for location and use of each light. Base cans shall as shown in the following table and considered part of the light unit. Contractor shall determine the size and location of hubs to connect to existing. Unused hubs shall be sealed per manufacturer's recommendations and the specifications.

c. Taxiway Edge Light, Elevated. Elevated taxiway edge lights shall conform to the requirements of FAA specification(s) and the following table and as indicated on the drawings. Base cans shall be as shown in the following

table and considered part of the light unit. Unused hubs shall be sealed per manufacturer's recommendations and the specifications.

d. Base Can Mounted Light Extension. Base can mounted light extensions and spacer rings to bring light bases level to adjacent finished grade or concrete collar and shall be manufacturer supplied riser collars or hot-dipped galvanized shims as required for installation as indicated on the drawings and approved by the RPR. Extensions and rings shall be fabricated and installed based on field measurements. Threads of stainless steel hardware shall be coated with an anti-seize compound. Gaskets shall be installed between extensions, base cans, rings and fixture bases. Any gap around the extensions shall be completely sealed as approved by the manufacturer. The minimum riser ring provided by the manufacturer shall be used in place of multiple shims unless otherwise approved by the RPR. Unless otherwise shown as a bid item, payment for base can light extensions shall be included in the runway edge/threshold light pay items.

Lights

Type	Class	Mode	Style	Option	Base	Filter	Transformer	Notes
L-861	N/A	Mode 1	N/A				L-830	14" Height; incandescent
L-861SE	N/A	Mode 1	N/A				L-830	14" Height; incandescent
L-861T	N/A	Mode 1	N/A				L-830	14" Height; incandescent

125-2.8 RUNWAY AND TAXIWAY SIGNS. Runway and Taxiway Guidance Signs shall conform to the requirements of AC 150/5345-44 and the following table and as indicated on the drawings. Sign legend, background, and lettering, and location shall be as shown on the Drawings. The number of modules for the legend shall be as required by manufacturer. Signs shall include base can, Portland Cement Concrete (PCC) pad, and other incidentals required for complete installation as shown on the drawings.

Power shall be through the leg with externally-accessible on/off switch, with transformer remote mounted in base can offset from the sign leg. No wiring or conduit shall be exposed.

Signs

Type	Size	Style	Class	Mode	Notes
L-858Y	Size 2	Style 2	Class 2	Mode 2	LED
L-858R	Size 2	Style 2	Class 2	Mode 2	LED
L-858L	Size 2	Style 2	Class 2	Mode 2	LED
L-858B	Size 4	Style 2	Class 2	Mode 2	LED

125-2.9 RUNWAY END IDENTIFIER LIGHT (REIL). The REIL fixtures shall meet the requirements of AC 150/5345-51, Type L-849I, Style E REIL shall be an adjustable series-circuit current-sensing control. REIL is to use LED lighting devices. Master-slave control wire shall meet manufacturer's requirements or XHHW-2 wire type. Baffles will be provided as indicated on the drawings and are subject to submittal, review and approval.

125-2.10 PRECISION APPROACH PATH INDICATOR (PAPI). Provide and install a PAPI System serving Runway 29 and Runway 11 (if awarded), complete with control, lamps, mounting accessories, and aiming instrument set. PAPI shall receive power from the EEB with no remote control. The light units for the PAPI shall meet the requirements of AC 150/5345-28, Type L-880, Style B**,** Class I.

The new constant current power supply, series plug cutout, and installation thereof as well as the installation of conduit and cable from the electrical equipment building to PAPI master shall conform to Specification Items L-108 L-109, and L-110. PAPI day-night control and anti-fogging shall be controlled by the L-821/841 and L-854 located in the EEB. A new circuit and installation thereof as well as the installation of conduit and cable from the electrical equipment building to PAPI master shall conform to Specification Items L-108 L-109, and L-110.

125-2.11 CIRCUIT SELECTOR CABINET. Not required.

125-2.12 LIGHT BASE, JUNCTION CANS, AND TRANSFORMER HOUSINGS. Light Base, junction cans for splice boxes, and Transformer Housings shall conform to the requirements of AC 150/5345-42. Light bases shall be Type L-867 and L-868, Class 1A, Size B shall be provided as indicated on the drawings 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. The location of hubs for various installation locations shall be field verified by the Contractor, and if a new system, as shown on the plans and details in the Drawings or, if not shown, shall be submitted for approval. Cans shall have interior and exterior grounding lugs and drain hole. L-867 used as junction cans shall have heavy covers with bolt head recesses.

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.

125-2.14 CONCRETE. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures. Where reinforced concrete is specified, reinforcing steel shall conform to ASTM A615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

125-2.15 CONDUIT. Conduit shall conform to Item L-110, "Airport Underground Electrical Duct Banks and Conduits." Conduits entering any building, structure, or equipment shall be sealed with an approved “duct-seal.”

125-2.16 WIRE. Wire shall conform to Item L-108, “Underground Power Cable for Airports.” Unless otherwise shown on the plans, install new No. 8 AWG, 5kV and 600V cable as required and indicated on the plans. Splicing shall be performed in junction can or handhole and shall be an approved submersible in-line splices, submittal required. Bolted or taped splices shall not be used.

125-2.17 LIGHT FIXTURE IDENTIFICATION. An identification marker with approved numbering/lettering shall be provided for every elevated light. Marker shall be as shown on the drawings adjusted for size to accommodate as many letter/numbers as required for the application. Marker and labeling scheme is subject to submittal. Reflective adhesive numbers/letters shall be used to designate each and every elevated light. Markers shall be installed to be visible from adjacent taxiway or runway. Light marking is incidental to the light installation.

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 or accepted shop drawings.

Tolerances given in the FAA Advisory Circulars, these Specifications, and the Drawings shall not be exceeded. Where no tolerance is given, no deviation is permitted. Items not installed in accordance with the FAA Advisory Circulars, these Specifications, and Drawings shall be replaced by and at the expense of the Contractor.

a. Assemble units and connect to the system in accordance with the manufacturer's recommendations and instructions.

b. Provide 5 feet of slack in each cable in each base can.

c. Painted and galvanized surfaces that are damaged shall be repaired according to the manufacturer's recommendations, to the satisfaction of the Engineer. All areas to be field galvanized shall be dry and free of all cutting debris, welding debris, oil, grease or any contamination, immediately prior to application of the compound. Application shall consist of a minimum of three coats and a minimum dry film thickness of 3.0 mils. Application of the galvanizing compound shall be applied within 2 hours of the damage to the galvanized surface. Application of the galvanizing compound should extend a minimum of 3 inches beyond the edges of the damaged area.

d. All airfield lighting bolting hardware and threaded connections, i.e., frangible couplings, shall be coated with a water-proof anti-seize compound appropriate for the environment and materials before being screwed together. Anti-seize compound is subject to submittal and review.

There must be no exposed power/control cables between the point where they leave the underground (DEB or L-867 bases) and where they enter the equipment enclosures such as taxiway signs, PAPI, REIL, etc. These cables must be enclosed in rigid conduit or in flexible water-tight conduit with frangible coupling(s) at the grade or the housing cover, as shown in applicable details. Where LFMC is used outdoors, it shall be CPE or TPU-coated.

125-3.2 RUNWAY END IDENTIFIER LIGHTS. Install REIL System, complete with foundations, conduit, power cable, power transformers, control cable, power supply, adapter unit, lamps, remote head support, grounding, and mounting accessories as indicated on the Drawings and in conformance with AC 150/5340-14B and AC 150/5345-51. Follow manufacturer’s installation requirements.

125-3.3 PAPI SYSTEM INSTALLATION. Install PAPI System as indicated on the Drawings in conformance with AC 150/5340-30 150/5345-28 and in accordance with manufacturer's instructions. PAPI is to be powered by constant current regulator in electrical equipment building (EEB). Power cables are required from the PAPI to the EEB and shall be installed and paid for under other bid items.

The fixture shall be oriented and leveled, using appropriate leveling fixtures if necessary, so that it is within 1 degree of level and within 1 degree of parallel to the runway centerline. Final adjustment of the Optical System shall be made at night, following manufacturer's instructions, and shall be to the satisfaction of the RPR.

New PAPI shall be configured to operate 5.4-5.6 Amps at night and 6.5-6.7 Amps by day. Control will be provided by the constant current regulator.

a. Wire and Connections. The Contractor shall make all necessary electrical connections in accordance with the wiring diagrams furnished and as directed by the RPR. 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. Seal conduits using DuctSeal upon completion of wire installation.

b. Ground Connection and Ground Rod. The Contractor shall furnish and install a ground rod, grounding cable, and ground clamps for grounding the frame of the assembly near the base. The ground rod shall be of the diameter and length specified in the Drawings and shall be stainless steel, solid copper or copper-clad steel as indicated. The ground rod shall be driven into the ground adjacent to the concrete foundation so that the top is at least 6 inches below grade. The grounding cable shall consist of No. 6 AWG bare copper wire or larger and shall be firmly attached to the ground rod by means of an irreversible connection. The other end of the grounding cable shall be securely attached to a leg or to the base of the pipe support with noncorrosive metal and shall be of substantial construction; a clamp designed for grounding shall be used.

c. Field Lighting. Stencil vertical aiming angles on the outside of each PAPI lamp housing. The numerals must be black and one -inch minimum height.]

125-3.4 EXISTING AIRPORT LIGHTING SYSTEMS DURING CONSTRUCTION. Protect existing airport lighting systems. Any portion of the existing airport lighting systems damaged or disconnected during installation of the new systems shall be repaired and reconnected and must be fully functional prior to dusk each day or during adverse weather conditions, to the satisfaction of the RPR. This work shall be at no additional cost to the Owner.

125-3.5 TAXIWAY GUIDANCE SIGN INSTALLATION. The taxiway guidance signs shall be assembled in accordance with the manufacturer's instructions. The transformer secondary leads shall be connected to the lamp leads by means of a disconnecting plug and receptacle, and the joint shall not be taped. The proper lamp(s) shall be installed in the sign.

The sign shall be installed level and true. Horizontal level shall not exceed ¼-inch per foot. Vertical face level shall not exceed 1/8-inch per foot. Sign alignment shall be as shown on the drawings and shall be within 5-dgrees of parallel or perpendicular to the runway or taxiway. Where the intersection angle is not right, the sign shall be aligned to within 5-dgrees as indicated by the RPR.

125-3.6 TESTING. All systems 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.

Up to two walk-throughs may be initiated by the Engineer during which the airfield lighting units would be required to be in operation. Additional walk-throughs may be necessary depending upon the number of discrepancies found on the previous walk-throughs.

The Contractor is responsible for lamp replacements and necessary maintenance of airfield items during the testing, construction, and walk-through periods.

Test cabling per Specification L-108.

The Contractor shall perform the necessary inspection and tests for some items concurrently with the installation because of subsequent inaccessibility of some components. The Engineer shall be notified by the Contractor 48 hours in advance of any testing.

125-3.7 SHIPPING AND STORAGE. Equipment shall be shipped in suitable packing material to prevent damage during shipping. Store and maintain equipment and materials in areas protected from weather and physical damage. Any equipment and materials, in the opinion of the RPR, damaged during construction or storage shall be replaced by the Contractor at no additional cost to the owner. Painted or galvanized surfaces that are damaged shall be repaired in accordance with the manufacturer’s recommendations.

125-3.8 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 Retroreflective markers will be measured by the number installed as completed units in place, ready for operation, and accepted by the RPR. 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 RPR. Guidance signs, distance remaining signs, and retroreflective signs will be measured by the number of each type and size installed as

completed units, in place, ready for operation, and accepted by the RPR. Runway End Identifier Lights (REIL) shall be measured by each system installed as a completed unit in place, ready for operation, and accepted by the RPR.

125.4.2. Precision Approach Path Indicator (PAPI) shall be measured by each system installed as a completed unit, in place, ready for operation, and accepted by the RPR.

BASIS OF PAYMENT

125-5.1 Payment will be made at the Contract unit price for each complete runway or taxiway light, guidance sign, reflective marker, runway end identification light system, precision approach path indicator, installed by the Contractor and accepted by the RPR. This payment will be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Bid Item No. 50	Distance Remaining Sign - per Each
Bid Item No. 51	L-849 REIL System, Runway 29 **-**per Each
Bid Item No. 52	L-880 PAPI System, Runway 29 - per Each
Bid Item No. 53	Retroreflective Marker - per Each
Bid Item No. 54	Taxiway Edge Light - per Each
Bid Item No. 55	Runway Medium Intensity Edge Light (MIRL) on Existing Base Can - per Each
Bid Item No. 56	Runway Threshold Light - per Each
Bid Item No. 57	Taxiway Guidance Sign, 1 Module - per Each
Bid Item No. 58	Taxiway Guidance Sign, 2 Module - per Each
Bid Item No. 59	Taxiway Guidance Sign, 4 Module - per Each
Bid Item No. 60	Retroreflective sign, Group 3 - per Each
Bid Item No. 61	Retroreflective sign, Group 4 - per Each
Bid Item No. B-1	L-849 REIL System, Runway 11 **-** per Each
Bid Item No. B-2	L-880 PAPI System, Runway 11 - per Each
Bid Item No. B-3	Taxiway Guidance Sign, 1 Module, On Existing Foundation - 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

SECTION VI

PREVAILING WAGE RATES

PREVAILING WAGE RATES - OREGON

THIS PROJECT IS A PUBLIC WORKS CONTRACT SUBJECT TO ORS 279C.800 TO 279C.870 AND THE DAVIS-BACON ACT (40 U.S.C. 276A).

ORS 279c.838 requires state prevailing wage rates to be paid on projects subject to both the state prevailing wage rate law and the Federal Davis-Bacon act, if the state prevailing rate of wage is higher than the federal prevailing rate of wage.

State prevailing wage rates, as set forth in the January 1, 2022 and any amendment(s) Bureau of Labor and Industry (BOLI) publication *"Prevailing Wage Rates for Public Contracts in Oregon Subject to both State PWR Law and The Federal Davis-Bacon Act"* are attached and applicable rates (including current amendments and corrections to that publication) are available at:
http://www.oregon.gov/boli/whd/pwr/pages/index.aspx

FEDERAL DAVIS-BACON WAGE RATES ARE ATTACHED

Oregon Bureau of Labor and Industries

Prevailing Wage Rates for Public Works Contracts

Val Hoyle
Labor Commissioner
Rates Effective January 1, 2022

VAL HOYLE
Labor Commissioner

In this rate book are the new prevailing wage rates for Oregon non-residential public works projects, effective January 1, 2022.

Prevailing wage rates are the minimum hourly wages that must be paid to all workers employed on all public works projects. In the 2021 Legislative Session, the Legislature passed Senate Bill (SB) 493 which was signed by the Governor with the effective date of January 1, 2022. SB 493 amends state PWR law (ORS 279C.815) and provides that the prevailing rate of wage for each locality is the wage in the collective bargaining agreement that covers that occupation. If more than one collective bargaining agreement covers that occupation, the highest rate of wage among the collective bargaining agreements will prevail. Accordingly, the rates in this book are determined using wage information from current collective bargaining agreements for each trade and occupation for each of the 14 geographic regions of the state.

Thank you for your engagement in the process and commitment to Oregon law.

Our team is ready to help support you with any questions you have. We also offer regular, free informational seminars and webinars for contractors and public agencies. Contact us at PWR.Email@boli.oregon.gov or (971) 353-2416.

Val Hoyle
Labor Commissioner

More information about prevailing wage rates:

The Oregon Bureau of Labor & Industries publishes the prevailing wage rates (PWR) that are required to be paid to workers on non-residential Oregon public works projects.

A separate document, *Definitions of Covered Occupations for Public Works Contracts in Oregon,* provides occupational definitions used to classify the duties performed on public works projects. These definitions are used to find the correct prevailing wage rate.

The rate book and definition publications are available online at https://www.oregon.gov/boli as well as additional information and supporting documents and forms.

Please contact us at PWR.Email@boli.oregon.gov or (971) 353-2416, for additional information such as:

- Applicable prevailing wage rates for projects (Generally, the rates in effect at the time the bid specifications are first advertised are those that apply for the duration of the project.)
- Federal Davis-Bacon rates (In cases where projects are subject to both state PWR and federal Davis-Bacon rates, the higher wage must be paid.)
- Required PWR provisions for specifications and contracts
- Apprentice rates

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JANUARY 1, 2022

Forms necessary to comply with ORS 279C.800 through ORS 279C.870 can be found on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage.aspx. Contractors are encouraged to use and keep on file the forms provided as master copies for use on future prevailing wage rate projects.

All of the information in this booklet can be accessed and printed from the Internet at: www.oregon.gov/BOLI

Pursuant to ORS 279C.800 to ORS 279C.870, the prevailing wage rates contained in this booklet have been adopted for use on public works contracts in Oregon.

Required Postings for Prevailing Wage Contractors and Subcontractors

PREVAILING WAGE RATES

Every contractor and subcontractor engaged in work on a public works must post the applicable prevailing wage rates for that project in an obvious place on the worksite so workers have ready access to the information.

DETAILS OF FRINGE BENEFIT PROGRAMS

When a contractor or subcontractor provides or contributes to a health and welfare plan or a pension plan, or both, for employees who are working on a public works project, the details of all fringe benefit plans or programs must be posted on the worksite.

The posting must include a description of the plan or plans, information about how and where claims can be made and where to obtain more information. The notice must be posted in an obvious place on the work site in the same location as the prevailing wage rates.

WORK SCHEDULE

Contractors and subcontractors must give workers the regular work schedule (days of the week and number of hours per day) in writing before beginning work on the project.

Contractors and subcontractors may provide the schedule at the time of hire, prior to starting work on the contract, or by posting the schedule in a location frequented by employees, along with the prevailing wage rate information and any fringe benefit information.

If an employer fails to give written notice of the worker's schedule, the work schedule will be presumed to be a five-day schedule. The schedule may only be changed if the change is intended to be permanent and is not designed to evade the PWR overtime requirements.

ORS 279C.840(4); OAR 839-025-0033(1). ORS 279C.840(5); OAR 839-025-0033(2). ORS 279C.540(2); OAR 839-025-0034.

PUBLIC WORKS BONDS

Every contractor and subcontractor who works on public works projects subject to the prevailing wage rate (PWR) law is required to file a $30,000 **"PUBLIC WORKS BOND"** with the Construction Contractors' Board (CCB). This includes flagging and landscaping companies, temporary employment agencies, and sometimes sole proprietors.

The key elements of ORS 279C.830(2) and ORS 279C.836 specify that:

- Specifications for every contract for public works must contain language stating that the contractor and every subcontractor must have a public works bond filed with the CCB before starting work on the project, unless otherwise exempt.
- Every contract awarded by a contracting agency must contain language requiring the contractor:
  - To have a public works bond filed with the CCB before starting work on the project, unless otherwise exempt; and
  - To include in every subcontract a provision requiring the subcontractor to have a public works bond filed with the CCB before starting work on the project unless otherwise exempt
- Every subcontract that a contractor or subcontractor awards in connection with a public works contract between a contractor and a public agency must require any subcontractor to have a public works bond filed with the CCB before starting work on the public works project, unless otherwise exempt.
- Before permitting a subcontractor to start work on a public works project, contractors must first verify their subcontractors either have filed the bond, or have elected not to file a public works bond due to a bona fide exemption.
- The PWR bond is to be used exclusively for unpaid wages determined to be due by the Bureau of Labor & Industries.
- The bond is in effect continuously (you do not have to have one per project).
- A public works bond is in addition to any other required bond the contractor or subcontractor is required to obtain.

Exemptions:

- Allowed for a disadvantaged business enterprise, a minority-owned business, woman-owned business, a business that a service-disabled veteran owns or an emerging small business certified under ORS 200.055, for the first FOUR years of certification;
  - Exempt contractor must still file written verification of certification with the CCB, and give the CCB written notice that they elect not to file a bond.
  - The prime contractor must give written notice to the public agency that they elect not to file a public works bond.
  - Subcontractors must give written notice to the prime contractor that they elect not to file a public works bond.
- For projects with a total project cost of $100,000 or less, a public works bond is not required. (Note this is the total project cost, not an individual contract amount.)
- Emergency projects, as defined in ORS 279A.010(f).

PREVAILING WAGE RATES

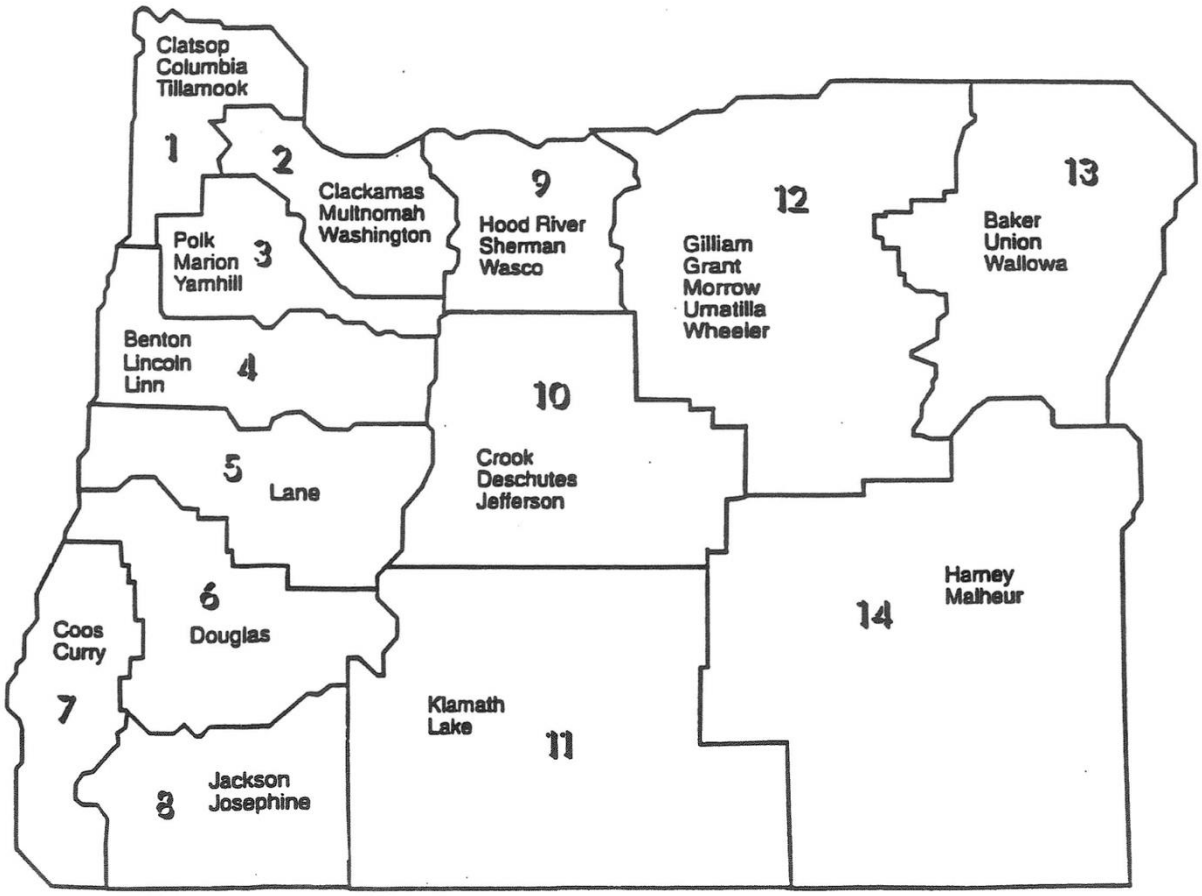
FINDING THE CORRECT PREVAILING WAGE RATE

To find the correct rate(s) required on your public works project, you will need:

- the date the project was first advertised for bid
- the county your project is in
- the duties of workers on the job

Generally, the rate you should look for is based on the date the project was first advertised for bid. (See OAR 839-025-0020(8) for information about projects that contract through a CM/GC, or contract manager/general contractor.)

The Labor Commissioner must establish the prevailing rate of wage for each region as defined in law. (See ORS 279C.800.) Each region is comprised of one to five counties. See below instructions on locating the correct prevailing wage rate for your public works project.



To find the correct rate in this rate book:

1. *Determine the duties that are being performed by each worker.* Use the booklet *Definitions of Covered Occupations* to find the definition that most closely matches the actual work performed by the worker. You can find this publication online at https://www.oregon.gov/boli/employers/Pages/occupational-definitions.aspx.

2. *Find the correct occupation in the "Prevailing Wage Rate for Public Works Contracts" below.* The prevailing wage rate is made up of an hourly base rate and an hourly fringe rate. The combination of these two amounts must be paid to each worker. Watch for possible zone differential, shift differential, and/or hazard pay. If the occupation lists different rates for different Areas of the state, locate the Area that includes the county where the project is located.

Apprentices must be paid consistent with their registered apprenticeship program standard. You can find apprenticeship rates on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage-rates.aspx. You may also contact the agency to confirm the correct apprenticeship rate.

The "Prevailing Wage Rate Laws" handbook provides specific information and answers questions regarding prevailing wage laws and is available on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage.aspx.

If you have any questions about any of this information, please contact the Bureau of Labor & Industries at PWR.Email@boli.oregon.gov or (971) 353-2416.

January 1, 2022

Prevailing Wage Rates by Occupations—Table of Contents

Using the booklet, Definitions of Covered Occupations, find the definition and group number, if applicable, that most closely matches the actual work being performed by the worker.

ASBESTOS WORKER/INSULATOR	**54.77**	**22.67**
Firestop Containment	**40.63**	**15.94**
BOILERMAKER	**40.46**	**30.59**
BRICKLAYER/STONEMASON	**41.83**	**23.18**

(This trade is tended by "Tenders to Mason Trades")

(Add $1.00 per hour to base rate for refractory repair work)

(Add $1.00 per hour to base rate for Terrazzo work.)

CARPENTER

Zone A (Base Rate)

Group 1	**43.80**	**18.56**
Group 2	**43.97**	**18.56**
Group 3	**46.89**	**18.56**
Group 4	**Eliminated**	
Group 5	**44.38**	**18.56**
Group 6	**44.97**	**18.56**

Zone Differential for Carpenters
(Add to Zone A Base Rate)

Zone B	**1.25** per hour
Zone C	**1.70** per hour
Zone D	**2.00** per hour
Zone E	**3.00** per hour
Zone F	**5.00** per hour
Zone G	**10.00** per hour

Zone A: Projects located within 30 miles of the respective city hall of the cities listed.
Zone B: More than 30 miles but less than 40 miles.
Zone C: More than 40 miles but less than 50 miles.
Zone D: More than 50 miles but less than 60 miles.
Zone E: More than 60 miles but less than 70 miles.
Zone F: More than 70 miles but less than 100 miles.
Zone G: More than 100 miles.

Reference Cities for Group 1 and 2 Carpenters

Albany	Goldendale	Madras	Roseburg
Astoria	Grants Pass	Medford	Salem
Baker City	Hermiston	Newport	The Dalles
Bend	Hood River	Ontario	Tillamook
Brookings	Klamath Falls	Pendleton	Vancouver
Burns	La Grande	Portland	
Coos Bay	Lakeview	Port Orford	
Eugene	Longview	Reedsport	

CARPENTER (continued)

Group 3
(Millwright)

Zones for Group 3 Carpenter are determined by the distance between the project site and **either**

1) The worker's residence; ***or***

2) City Hall of a reference city listed for the appropriate group shown, whichever is closer

Reference Cities for Group 3 Carpenters

Eugene	Medford	Portland	Vancouver
Longview	North Bend	The Dalles	

Group 5
(Bridge & Highway Carpenter)

Group 6
(Piledriver)

Zones for Groups 5 and 6 Carpenter are determined by the distance between the project site and **either**

1) The worker's residence; ***or***

2) City Hall of a reference city listed for the appropriate group shown, whichever is closer

Reference Cities for Group 5 and 6 Carpenters

Bend	Longview	North Bend
Eugene	Medford	Portland

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time--best road via Google Maps) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

Welders shall receive the following hourly premium over the base wage rate, with an eight (8) hour minimum:
Group 1 **$2.19** per hour
Group 2 **$2.20** per hour
Group 3 **$2.34** per hour
Group 5 **$2.22** per hour
Group 6 **$2.25** per hour

When working with creosote and other toxic, treated wood and steel material, workers shall receive $.25/hour premium pay for minimum of eight (8) hours.

When working in sheet pile coffer dams or cells up to the external water level, Group 6 workers shall receive $.15/hour premium pay for minimum of eight (8) hours.

CEMENT MASON
(This trade is tended by "Concrete Laborer")

Group 1	**36.72**	**22.07**
Group 2	**37.51**	**22.07**
Group 3	**37.51**	**22.07**
Group 4	**38.30**	**22.07**

See Zone Differentials on Page 8

CEMENT MASON (continued)

Zone Differential for Cement Mason
(Add to Basic Hourly Rate)

Zone A **3.00** per hour
Zone B **5.00** per hour
Zone C **10.00** per hour

Zone A: Projects located 60-79 miles of the respective city hall of the Reference Cities listed below.
Zone B: Projects located 80-99 miles of the respective city hall of the Reference Cities listed below.
Zone C: Projects located 100 or more miles of the respective city hall of the Reference Cities listed below.

Reference Cities for Cement Mason

Bend	Eugene	Pendleton	Salem	Vancouver
Corvallis	Medford	Portland	The Dalles	

When a contractor takes current employees to a project that is located more than 59 miles from the city hall of the Reference City that is closest to the contractor's place of business, Zone Pay is to be paid for the distance between the city hall of the identified Reference City and the project site.

Note: All miles are to be determined on the basis of road miles using the normal route (shortest time – best road), from the city hall of the Reference City closest to the contractor's place of business and the project.

DIVER & DIVER TENDER

Zone 1 (Base Rate)

DIVER	**93.09**	**18.56**
DIVER TENDER	**49.09**	**18.56**

1) For those workers who reside within a reference city below, their zone pay shall be computed from the city hall of the city wherein they reside.

2) For those workers who reside nearer to a project than is the city hall of any reference city below, the mileage from their residence may be used in computing their zone pay differential.

3) The zone pay for all other projects shall be computed from the city hall of the nearest reference city listed below.

Zone Differential for Diver/Diver Tender
(Add to Zone 1 Base Rate)

Zone 2 **1.25** per hour
Zone 3 **1.70** per hour
Zone 4 **2.00** per hour
Zone 5 **3.00** per hour
Zone 6 **5.00** per hour
Zone 7 **10.00** per hour

Zone 1: Projects located within 30 miles of city hall of the reference cities listed.
Zone 2: More than 30 miles, but less than 40 miles.
Zone 3: More than 40 miles, but less than 50 miles.
Zone 4: More than 50 miles, but less than 60 miles.
Zone 5: More than 60 miles, but less than 70 miles.
Zone 6: More than 70 miles, but less than 100 miles.
Zone 7: More than 100 miles.

See Reference Cities on page 9

DIVER & DIVER TENDER (continued)

Reference Cities for Diver/Diver Tender

Bend	Longview	North Bend
Eugene	Medford	Portland

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time--best road via Google Maps) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

Diver Depth Pay:

Depth Below Water Surface (FSW)	Daily Depth Pay
50-100 ft.	$2.00 per foot over 50 feet
101-150 ft.	$3.00 per foot over 100 feet
151-220 ft.	$4.00 per foot over 150 feet
Over 220 ft.	$5.00 per foot over 220 feet

The actual depth in FSW shall be used in determining depth premium.

Diver Enclosure Pay (working without vertical escape):

Distance Traveled in the Enclosure	Daily Enclosure Pay
0 – 25ft.	N/C
25 – 300 ft.	$1.00 per foot from the entrance
300 – 600 ft.	$1.50 per foot beginning at 300 ft.
Over 600 ft.	$2.00 per foot beginning at 600 ft.

DREDGER

Zone A (Base Rate)

Leverman (Hydraulic & Clamshell)	**51.46**	**16.15**
Assistant Engineer (Watch Engineer, Mechanic Machinist)	**48.30**	**16.15**
Tenderman (Boatman Attending Dredge Plant), Fireman	**46.81**	**16.15**
Fill Equipment Operator	**45.64**	**16.15**
Assistant Mate	**42.94**	**16.15**

Zone Differential for Dredgers
(Add to Zone A Base Rate)

Zone B	**3.00** per hour
Zone C	**6.00** per hour

Zone mileage based on road miles:

Zone A: Center of jobsite to no more than 30 miles from the city hall of Portland.
Zone B: More than 30 miles but not more than 60 miles.
Zone C: Over 60 miles.

DRYWALL, LATHER, ACOUSTICAL CARPENTER & CEILING INSTALLER

Zone 1 (Base Rate)

1. DRYWALL INSTALLER	**43.59**	**18.26**
2. LATHER, ACOUSTICAL CARPENTER & CEILING INSTALLER	**43.59**	**18.26**

Zone Differential for Lather, Acoustical Carpenter & Ceiling Installer

Zone mileage based on road miles:

Zone B	61-80 miles	**6.00** per hour
Zone C	81-100 miles	**9.00** per hour
Zone D	101 or more	**12.00** per hour

The correct transportation allowance shall be based on AAA road mileage from the City Hall of the transportation reference cities herein listed.

Reference Cities for Drywall, Lather, Acoustical Carpenter & Ceiling Installer

Albany	Bend	Grants Pass	Medford	Portland	Seaside
Astoria	Brookings	Hermiston	Newport	Reedsport	The Dalles
Baker	Coquille	Klamath Falls	North Bend	Roseburg	Tillamook
Bandon	Eugene	Kelso-Longview	Pendleton	Salem	Vancouver

ELECTRICIAN

Area 1 (Region 14)

Electrician	**38.49**	**17.74**
Lighting Maintenance and Material Handler	**19.95**	**10.00**

Reference County

Malheur

Shift Differential

1st Shift “day”	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift “swing”	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 7.5% for all hours worked
3rd Shift “graveyard”	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 15% for all hours worked.

When workers are required to work under compressed air or to work from trusses, scaffolds, swinging scaffolds, bosun’s chair or on building frames, stacks or towers at a distance, the following should be added to base rate.

50 – 90 feet to the ground	Add 1 ½ x the base rate
90+ feet to the ground	Add 2 x the base rate

Pursuant to ORS 279C.815(2)(b), the Electrician Area 6 rate is the highest rate of wage among the collective bargaining agreements for Electrician Areas 1 and 6.

ELECTRICIAN (continued)

Area 2 (Regions 12 and 13)

Electrician	**50.00**	**22.93**
Cable Splicer	**52.50**	**23.01**

Reference Counties

Baker	Grant	Umatilla	Wallowa
Gilliam	Morrow	Union	Wheeler

Add 50% of the base rate when workers are required to work under the following conditions:

1) Under compressed air with atmospheric pressure exceeding normal pressure by at least 10%.

2) From trusses, swing scaffolds, bosun's chairs, open platforms, unguarded scaffolds, open ladders, frames, tanks, stacks, silos and towers where the workman is subject to a direct fall of (a) more than 60 feet or (b) into turbulent water under bridges, powerhouses or spillway faces of dams.

Area 3 (Regions 4, 5, 6 and 7)

Electrician	**41.63**	**21.20**

Reference Counties

Coos Curry Douglas

Lane – **See Area 4** Lincoln – **See Area 4**

Shift Differential

1st Shift "day"	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 17% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 31% for all hours worked.

When workers are required to work under compressed air or where gas masks are required, or to work from trusses, all scaffolds including mobile elevated platforms, any temporary structure, bosun's chair or on frames, stacks, towers, tanks, within 15' of the leading edges of any building at a distance of:

50 – 75 feet to the ground	Add 1 ½ x the base rate
75+ feet to the ground	Add 2 x the base rate

High Time is not required to be paid on any permanent structure with permanent adequate safeguards (handrails, mid-rails, and toe guards). Any vehicle equipped with outriggers are exempted from this section.

Area 4 (Regions 3, 4, 5, and 10)

Electrician	**49.36**	**20.20**
Cable Splicer	**54.30**	**20.35**
Lighting Maintenance/Material Handler	**22.67**	**10.08**

ELECTRICIAN (continued)

Reference Counties for Area 4

Benton	Deschutes	Lane	Lincoln
Crook	Jefferson	Linn	

Marion – **See Area 5 rate** Polk – **See Area 5 rate** Yamhill – **See Area 5 rate**

Shift Differential

1st Shift "day"	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 17% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 31.4% for all hours worked.

Area 5 (Regions 1, 2, 3 and 9)

Electrician	**53.85**	**27.84**
Electrical Welder	**59.24**	**28.00**
Material Handler/Lighting Maintenance	**30.69**	**19.62**

Reference Counties

Clackamas	Hood River	Polk	Wasco
Clatsop	Marion	Sherman	Washington
Columbia	Multnomah	Tillamook	Yamhill

Shift Differential

1st Shift "day"	Between the hours of 7:00am and 5:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 3:00am	8 hours pay for 8 hours work plus 17.3% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 11:00am	8 hours pay for 8 hours work plus 31.4% for all hours worked.

Zone Pay for Area 5-**Electrician and Electrical Welder**
(Add to Basic Hourly Rate)

Zone mileage based on air miles:

Zone 1	31-50 miles	**1.50** per hour
Zone 2	51-70 miles	**3.50** per hour
Zone 3	71-90 miles	**5.50** per hour
Zone 4	Beyond 90	**9.00** per hour

There shall be a 30-mile free zone from downtown Portland City Hall and a similar 15-mile free zone around the following cities:

Astoria	Seaside	Tillamook
Hood River	The Dalles	

Further, the free zone at the Oregon coast shall extend along Hwy 101 west to the ocean Hwy 101 east 10 miles if not already covered by the above 15-mile free zone.

ELECTRICIAN (continued)

Area 6 (Regions 6, 8, 11 and 14)

Electrician	**38.49**	**17.74**
Lighting Maintenance and Material Handler	**19.95**	**10.00**

Reference Counties

Harney	Josephine	Lake
Jackson	Klamath	Malheur

Douglas – **See Area 3 rate**

Shift Differential

1st Shift "day"	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 7.5% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 15% for all hours worked.

When workers are required to work under compressed air or to work from trusses, scaffolds, swinging scaffolds, bosun's chair or on building frames, stacks or towers at a distance, the following should be added to base rate.

50 – 90 feet to the ground	Add 1 ½ x the base rate
90+ feet to the ground	Add 2 x the base rate

ELEVATOR CONSTRUCTOR, INSTALLER AND MECHANIC

Area 1 (Regions 12 and 13)

Mechanic	**59.70**	**43.48**

Reference Counties

Baker	Union	Wallowa

Umatilla – **See Area 2 rate**

Area 2 (Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14)

Mechanic	**59.95**	**43.68**

Reference Counties

Benton	Douglas	Klamath	Multnomah	Deschutes
Clackamas	Gilliam	Lake	Polk	Josephine
Clatsop	Grant	Lane	Sherman	Morrow
Columbia	Harney	Lincoln	Tillamook	Wheeler
Coos	Hood River	Linn	Umatilla	Yamhill
Crook	Jackson	Malheur	Wasco	
Curry	Jefferson	Marion	Washington	

FENCE CONSTRUCTOR (NON-METAL)	**29.40**	**11.35**
FENCE ERECTOR (METAL)	**22.40**	**4.86**
GLAZIER	**47.10**	**21.12**

(Add $1.00 to base rate when employee works from a swing stage, scaffold, suspended contrivance or mechanical apparatus from the third floor up or thirty feet of free fall (whichever is less), and employee is required to wear a safety belt.)

(Add $4.00 to base rate when employee works from a bosun chair (non-motorized single-man apparatus), regardless of height.)

HAZARDOUS MATERIALS HANDLER	**27.03**	**13.18**
HIGHWAY/PARKING STRIPER	**36.47**	**14.22**

Shift Differential
Add $1.85 to base rate for shifts that start between 3:00pm and 4:00am.

IRONWORKER

Zone 1 (Base Rate):	**40.56**	**29.79**

Zone Differential for Ironworker
(Add to Basic Hourly Rate)

Zone 2 **5.63/**hr. or $45.00 maximum per day
Zone 3 **8.75**/hr. or $70.00 maximum per day
Zone 4 **11.25/**hr. or $90.00 maximum per day

Zone 1: Projects located within 45 miles of city hall in the reference cities listed below.
Zone 2: More than 46 miles, but less than 60 miles.
Zone 3: More than 61 miles, but less than 100 miles.
Zone 4: More than 100 miles.

Note: Zone pay for Ironworkers shall be determined using the quickest route per Google Maps and computed from the city hall or dispatch center of the reference cities listed below **or** the residence of the employee, whichever is nearer to the project.

Reference Cities and Dispatch Center

Medford Portland

LABORER

Zone A (Base Rate):

Group 1	**33.48**	**16.05**
Group 2	**34.71**	**16.05**
Group 3 (Flagger)	**29.04**	**16.05**
Group 4	**23.04**	**16.05**

See Laborer Hazardous Waste Removal Differential and Zone Differential page 15.

LABORER (continued)

Note: A Hazardous Waste Removal Differential must be added to the base rate if work is performed inside the boundary of a Federally Designated Hazardous Waste Site. A Group 1 base rate is used for General Laborer on such a site. For further information on this, call the Prevailing Wage Rate Coordinator at (971) 353-2416.

Any Laborer working in Live Sewers shall receive forty dollars ($40) per day in addition to their regular pay.

Zone Differential for Laborers
(Add to Zone A Base Rate)

Zone B	**.85** per hour
Zone C	**1.25** per hour
Zone D	**2.00** per hour
Zone E	**4.00** per hour
Zone F	**5.00** per hour

Zone A: Projects located within 30 miles of city hall in the reference cities listed.
Zone B: More than 30 miles but less than 40 miles.
Zone C: More than 40 miles but less than 50 miles.
Zone D: More than 50 miles but less than 80 miles.
Zone E: More than 80 miles but less than 100 miles.
Zone F: More than 100 miles.

Reference Cities for Laborer

Albany	Burns	Hermiston	Roseburg
Astoria	Coos Bay	Klamath Falls	Salem
Baker City	Eugene	Medford	The Dalles
Bend	Grants Pass	Portland	

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time, best road) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all other project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

LANDSCAPE LABORER/TECHNICIAN (Laborer Group 4)	**23.04**	**16.05**

LIMITED ENERGY ELECTRICIAN

Area 1 (Region 14)	**33.76**	**14.26**

Reference County

Malheur

Pursuant to ORS 279C.815(2)(b), the Limited Energy Electrician Area 6 rate is the highest rate of wage among the collective bargaining agreements for Limited Energy Electrician Areas 1 and 6.

Area 2 (Regions 12 and 13)	**33.19**	**15.16**

Reference Counties

Baker	Grant	Umatilla	Wallowa
Gilliam	Morrow	Union	Wheeler

LIMITED ENERGY ELECTRICIAN (continued)

Area 3 (Regions 4, 5, 6 and 7)	**32.16**	**18.24**

Reference Counties

Coos Curry Douglas

Lane – **See Area 4** Lincoln – **See Area 4**

Area 4 (Regions 3, 4, 5 and 10)	**36.17**	**17.26**

Reference Counties

Benton Jefferson Linn
Crook Lane Lincoln
Deschutes

Marion – **See Area 5 rate** Polk – **See Area 5 rate** Yamhill – **See Area 5 rate**

Area 5 (Regions 1, 2, 3 and 9)	**44.23**	**22.30**

Reference Counties

Clackamas Hood River Polk Wasco
Clatsop Marion Sherman Washington
Columbia Multnomah Tillamook Yamhill

Area 6 (Regions 6, 8, 11 and 14)	**33.76**	**14.26**

Reference Counties

Harney Josephine Lake
Jackson Klamath Malheur

Douglas – **See Area 3 rate**

LINE CONSTRUCTOR

Area 1 (All Regions)

Group 1	**62.40**	**23.21**
Group 2	**55.71**	**22.91**
Group 3	**33.05**	**15.49**
Group 4	**47.91**	**19.36**
Group 5	**41.78**	**16.78**
Group 6	**34.54**	**16.36**
Group 7	**19.24**	**12.42**

Reference Counties

All counties

LINE CONSTRUCTOR (continued)

Area 2 (Region 14)

Cable Splicer	**62.40**	**23.21**
Journeyman Lineman	**55.71**	**22.91**
Line Equip. Operator	**47.91**	**19.36**
Groundman	**34.54**	**16.36**

Reference County

Malheur – **See Area 1 rates**

Pursuant to ORS 279C.815(2)(b), the Line Constructor Area 1 rate is the highest rate of wage among the collective bargaining agreements for Line Constructor Area 1 and Area 2.

MARBLE SETTER	**42.83**	**23.18**

(This trade is tendered by "Tile, Terrazzo, & Marble Finishers")

(Add $1.00 per hour to base rate for refractory repair work)

PAINTER & DRYWALL TAPER

COMMERCIAL PAINTING	**28.76**	**13.84**
INDUSTRIAL PAINTING	**30.56**	**13.84**
BRIDGE PAINTING	**36.23**	**13.84**

DRYWALL TAPER

Zone A (Base Rate	**41.10**	**18.75**

Zone Differential for Drywall Taper
(Add to Zone A Base Rate)

Zone B **6.00** per hour
Zone C **9.00** per hour
Zone D **12.00** per hour

Dispatch Cities for Drywall Taper

Albany	Bend	Grants Pass	Medford	Portland	Seaside
Astoria	Brookings	Hermiston	Newport	Reedsport	The Dalles
Baker	Coquille	Klamath Falls	North Bend	Roseburg	Tillamook
Bandon	Eugene	Kelso-Longview	Pendleton	Salem	Vancouver

Zone A: Projects located less than 61 miles of the respective city hall of the dispatch cities listed.
Zone B: Projects located 61 miles to 80 miles.
Zone C: Projects located 81 miles to 100 miles.
Zone D: Projects located 101 miles or more.

Note: Zone pay is based on AAA Road Mileage.

PLASTERER AND STUCCO MASON

(This trade is tended by "Tenders to Plasterers")

Zone A (Base Rate)

Plasterer	**39.65**	**18.98**
Swinging Scaffold	**40.65**	**18.98**
Nozzleman	**41.65**	**18.98**

Zone Differential for Plasterer and Stucco Mason
(Add to Zone A Base Rate)

Zone B **6.00** per hour
Zone C **9.00** per hour
Zone D **12.00** per hour

Zone A: Projects located less than 61 miles of the respective city hall of the reference cities listed below.
Zone B: Projects located 61 miles to 80 miles.
Zone C: Projects located 81 miles to 100 miles.
Zone D: Projects located 101 miles or more.

Reference Cities for Plasterer & Stucco Mason

Bend	Eugene	Medford	Portland	Seaside
Coos Bay	La Grande	Newport	Salem	The Dalles

PLUMBER/PIPEFITTER/STEAMFITTER

Area 1 (Regions 13 and 14)	**33.00**	**16.57**

Reference Counties

Harney Malheur

Baker – **See Area 2 rates**

(Add $2.21 to base rate if it is possible for worker to fall 30 ft. or more, or if required to wear a fresh-air mask or similar equipment for 2 hours or more)

Zone Differential for Area 1
(Add to Base Rate)
Zone 1 **2.50** per hour
Zone 2 **3.50** per hour
Zone 3 **5.00** per hour

Zone mileage based on road miles:
Zone 1: Forty (40) to fifty five (55) miles from City Hall in Boise, Idaho.
Zone 2: Fifty five (55) to one hundred (100) miles from City Hall in Boise, Idaho.
Zone 3: Over one hundred (100) miles from City Hall in Boise, Idaho.

There shall be a maximum of ten (10) hours of zone pay per workday.

PLUMBER/PIPEFITTER/STEAMFITTER (continued)

Area 2 (Regions 12 and 13)	**53.00**	**33.39**

Reference Counties

Baker	Grant	Umatilla	Wallowa
Gilliam	Morrow	Union	Wheeler

Zone Differential for Area 2
(Add to Base Rate)

Zone 2 **10.62/**hr. not to exceed $80.00 day.

Zone mileage based on road miles:

Zone 2: Eighty (80) miles or more from City Hall in Pasco, Washington.

(Add $1.00 to base rate if it is possible for worker to fall 35 ft. or more, or if required to wear a fresh-air mask or similar equipment for one-hour minimum increments)

Area 3 (Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12)	**48.93**	**34.04**

Reference Counties

Benton	Deschutes	Lake	Sherman
Clackamas	Douglas	Lane	Tillamook
Clatsop	Hood River	Lincoln	Wasco
Columbia	Jackson	Linn	Washington
Coos	Jefferson	Marion	Yamhill
Crook	Josephine	Multnomah	
Curry	Klamath	Polk	

Gilliam – **See Area 2 rate** Wheeler – **See Area 2 rate**

POWER EQUIPMENT OPERATOR

Zone 1 (Base Rate)		
Group 1	**51.65**	**16.35**
Group 1A	**53.81**	**16.35**
Group 1B	**55.97**	**16.35**
Group 2	**49.74**	**16.35**
Group 3	**48.59**	**16.35**
Group 4	**45.26**	**16.35**
Group 5	**44.02**	**16.35**
Group 6	**40.80**	**16.35**

See Power Equipment Operator Zone 1 Map on page 21.

(Group 4 Tunnel Boring Machine Mechanic add $10.00/hour hyperbaric pay)

Note: A Hazardous Waste Removal Differential must be added to the base rate if work is performed inside the boundary of a Federally Designated Waste Site. For information on this differential, call the Prevailing Wage Rate Coordinator at (971) 353-2416.

(Add $0.40 to the base rate for any and all work performed underground, including operating, servicing and repairing of equipment)

POWER EQUIPMENT OPERATOR (continued)

(Add $0.50 to the base rate per hour for any employee who works suspended by a rope or cable)

(Add $0.50 to the base rate for employees who do "pioneer" work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation)

Shift Differential

Two-Shift Operations:

On a two shift operation, when the second shift starts after 4:30 p.m., second-shift workers shall be paid the base hourly wage rate plus 5% for all hours worked.

When the second shift starts at 8:00 p.m. or later, the second-shift workers shall be paid at the base hourly wage rate plus 10% for all hours worked.

Three-Shift Operations:

On a three-shift operation, the base hourly wage rate plus five percent (5%) shall be paid to all second-shift workers for all hours worked, and the base hourly wage rate plus ten percent (10%) shall be paid to all third shift workers for all hours worked.

Zone Pay Differential for Power Equipment Operator
(Add to Zone 1 Base Rate)

Zone 2	**3.00** per hour
Zone 3	**6.00** per hour

For projects in the following metropolitan counties:

Clackamas	Marion	Washington
Columbia	Multnomah	Yamhill

(A) All jobs or projects located in Multnomah, Clackamas and Marion counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Hwy 26 and West of Mile Post 30 on Hwy 22 and all jobs located in Yamhill County, Washington County and Columbia County shall receive Zone 1 pay for all classifications.

(B) All jobs or projects located in the area outside the *identified boundary* above, but less than 50 miles from the Portland City Hall shall receive Zone 2 pay for all classifications.

(C) All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone 3 pay for all classifications.

Reference cities for projects in all remaining counties:

Albany	Coos Bay	Grants Pass	Medford
Bend	Eugene	Klamath Falls	Roseburg

(A) All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone 1 pay for all classifications.

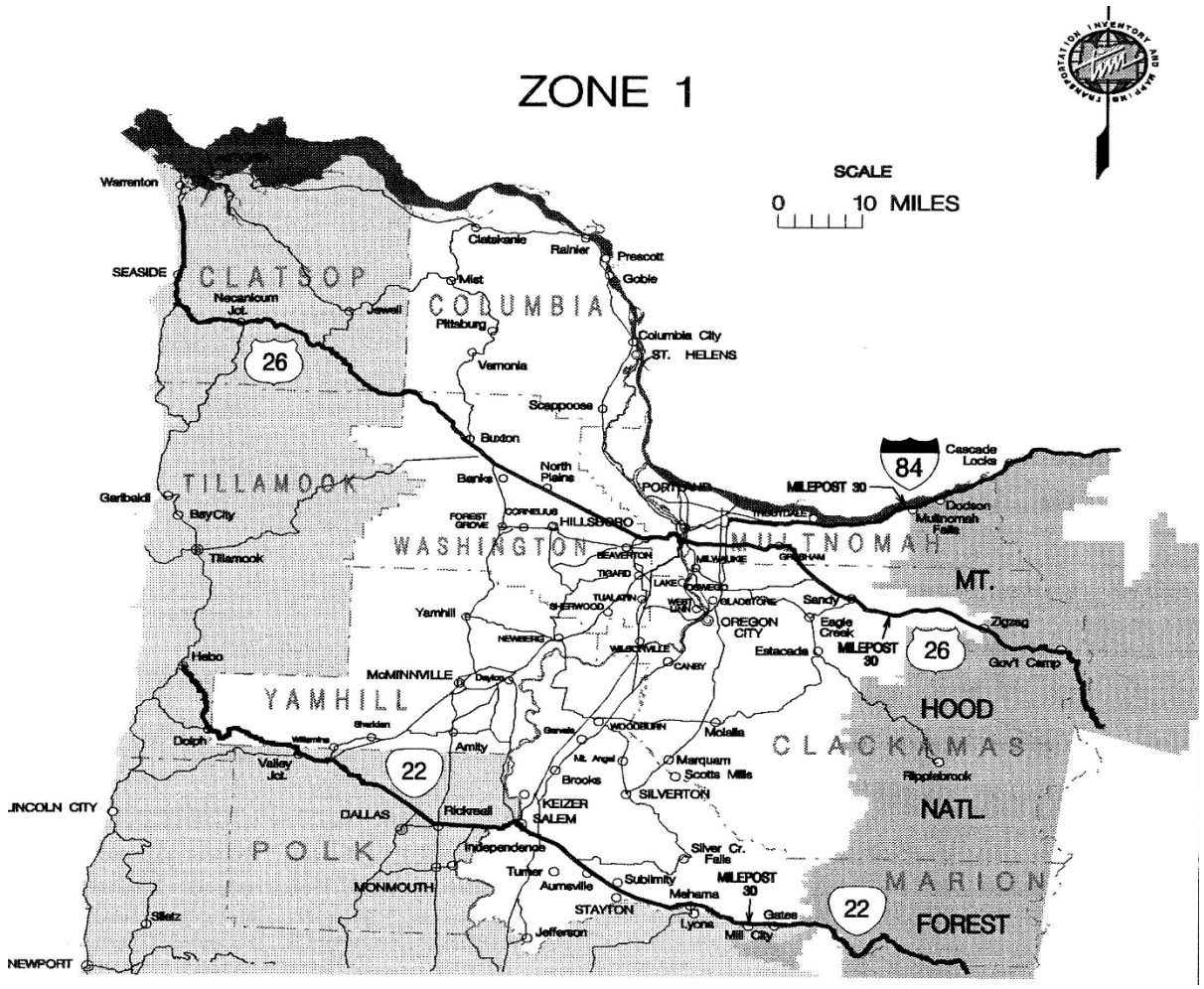
(B) All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone 2 for all classifications.

(C) All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone 3 pay for all classifications.

POWER EQUIPMENT OPERATOR (continued)

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time-best road) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all other project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

POWER EQUIPMENT OPERATOR MAP



ROOFER

Area 1 (Regions 1, 2, 9, 10, 12 and 13)

Roofer	**37.43**	**20.19**
Handling coal tar pitch	**41.17**	**20.19**
Remove fiberglass insulation	**41.17**	**20.19**

Reference Counties

Baker	Deschutes	Morrow	Union
Clackamas	Gilliam	Multnomah	Wasco
Clatsop	Grant	Sherman	Wallowa
Columbia	Hood River	Tillamook	Washington
Crook	Jefferson	Umatilla	Wheeler

Area 2 (Regions 3, 4, 5, 6, 7, 8, 10, 11 and 14)

Roofer	**30.05**	**18.59**
Handling coal tar pitch	**32.05**	**18.59**
Remove fiberglass insulation	**31.55**	**18.59**

Reference Counties

Benton	Harney	Lake	Malheur
Coos	Jackson	Lane	Marion
Curry	Josephine	Lincoln	Polk
Douglas	Klamath	Linn	Yamhill

Crook – **See Area 1 rates** Deschutes – **See Area 1 rates**

Area 4 (Regions 12 and 13)

Roofer	**37.43**	**20.19**
Handling coal tar pitch	**41.17**	**20.19**
Remove fiberglass insulation	**41.17**	**20.19**

Reference Counties

Umatilla Union Wallowa

Pursuant to ORS 279C.815(2)(b), the Roofer Area 1 rate is the highest rate of wage among the collective bargaining agreements for Roofer Areas 1, 4 and 5.

Area 5 (Region 12)

Roofer	**37.43**	**20.19**
Handling coal tar pitch	**41.17**	**20.19**
Remove fiberglass insulation	**41.17**	**20.19**

Reference County

Morrow

Pursuant to ORS 279C.815(2)(b), the Roofer Area 1 rate is the highest rate of wage among the collective bargaining agreements for Roofer Areas 1, 4 and 5.

SHEET METAL WORKER

Area 1 (Regions 1, 2, 3, 4, 9 and 12) **44.05** **24.28**

Reference Counties

Benton	Grant	Morrow	Umatilla
Clackamas	Hood River	Multnomah	Wasco
Clatsop	Lincoln	Polk	Washington
Columbia	Linn	Sherman	Wheeler
Gilliam	Marion	Tillamook	Yamhill

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

Area 2 (Regions 13 and 14) -------- --------

Reference Counties

Baker – **See Area 3 rate** Malheur – **See Area 6 rate**

Area 3 (Regions 12 and 13) **42.35** **23.87**

Reference Counties

Baker Union Wallowa

Morrow – **See Area 1 rate** Umatilla – **See Area 1 rate**

(Add $.45 to base rate for work performed on any swinging stage, swinging scaffold or boson chair in excess of thirty (30) feet above the ground)

(Add $1.00 to base rate for work where it is necessary to wear a chemically activated type face mask)

Area 4 (Regions 5 and 6) **36.38** **21.74**

Reference Counties

Douglas Lane

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

Area 5 (Region 7) **36.72** **22.77**

Reference Counties

Coos Curry

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

SHEET METAL WORKER (continued)

Area 6 (Regions 7, 8, 11 and 14) **30.93** **20.53**

Reference Counties

Harney	Josephine	Lake
Jackson	Klamath	Malheur

Curry – **See Area 5 rate**

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

Area 7 (Region 10) **34.01** **20.36**

Reference Counties

Crook	Deschutes	Jefferson

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

SOFT FLOOR LAYER **33.75** **19.35**

SPRINKLER FITTER

Area 1 (Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14) **42.15** **25.30**

Reference Counties

Benton	Douglas	Klamath	Multnomah
Clackamas	Gilliam	Lake	Polk
Clatsop	Grant	Lane	Sherman
Columbia	Harney	Lincoln	Tillamook
Coos	Hood River	Linn	Umatilla
Crook	Jackson	Malheur	Wasco
Curry	Jefferson	Marion	Washington
Deschutes	Josephine	Morrow	Wheeler
			Yamhill

Area 2 (Regions 12, 13, 14) **36.08** **25.29**

Reference Counties

Baker	Union	Wallowa

Gilliam – **See Area 1 rate** Malheur – **See Area 1 rate** Umatilla – **See Area 1 rate**
Grant – **See Area 1 rate** Morrow – **See Area 1 rate**

TENDER TO MASON TRADES (Brick and Stonemason, Mortar Mixer, Hod Carrier) **36.54** **16.05**

(Add $0.50 to base rate for refractory repair work)

TENDER TO PLASTERER AND STUCCO MASON

Zone A (Base Rate)	**36.37**	**16.80**

Zone Differential for Tender to Plasterer and Stucco Mason
(Add to Zone A Base Rate)

Zone B **6.00** per hour
Zone C **9.00** per hour
Zone D **12.00** per hour

Zone A: Projects located within 60 miles of city hall in the reference cities listed.
Zone B: More than 61 miles but less than 80 miles.
Zone C: More than 81 miles but less than 100 miles.
Zone D: More than 101 miles

Reference Cities

Bend	Eugene	Medford	Salem	The Dalles
Coos Bay	La Grande	Newport	Seaside	

(Add $0.50 to base rate for refractory repair work)

TESTING AND BALANCING (TAB) TECHNICIAN

For work performed under the Sheet Metal classification, including Air-Handling Equipment, Ductwork

See SHEET METAL WORKER RATE

For work performed under the Plumber/Pipefitter/Steamfitter classification, including Water Distribution Systems

See PLUMBER/PIPEFITTER/STEAMFITTER RATE

TILESETTER/TERRAZZO WORKER: Hard Tilesetter	**35.90**	**20.40**

(This trade is tended by “Tile, Terrazzo, & Marble Finisher”)

(Add $1.00 to base rate refractory repair work)

(Add $1.00 for Terrazzo work)

TILE, TERRAZZO, AND MARBLE FINISHER

1. TILE, TERRAZZO FINISHER	**27.04**	**14.90**

(Add $1.00 to base rate for refractory repair work)

(Add $1.00 for Terrazzo work)

2. BRICK & MARBLE FINISHER	**27.04**	**14.64**

(Add $1.00 to base rate for refractory repair work)

TRUCK DRIVER

Zone A (Base Rate)

Group 1	**30.09**	**16.73**
Group 2	**30.23**	**16.73**
Group 3	**30.37**	**16.73**
Group 4	**30.67**	**16.73**
Group 5	**30.91**	**16.73**
Group 6	**31.10**	**16.73**
Group 7	**31.32**	**16.73**

Zone differential for Truck Drivers
(Add to Zone A Base Rate)

Zone B	**.65** per hour
Zone C	**1.15** per hour
Zone D	**1.70** per hour
Zone E	**2.75** per hour

Zone A: Projects within 30 miles of the cities listed.
Zone B: More than 30 miles but less than 40 miles.
Zone C: More than 40 miles but less than 50 miles.
Zone D: More than 50 miles but less than 80 miles.
Zone E: More than 80 miles.

Reference Cities

Albany	Burns	Hermiston	Madras	Oregon City	Roseburg
Astoria	Coos Bay	Hood River	Medford	Pendleton	Salem
Baker	Corvallis	Klamath Falls	McMinnville	Portland	The Dalles
Bend	Eugene	La Grande	Newport	Port Orford	Tillamook
Bingen	Goldendale	Lakeview	Ontario	Reedsport	Vancouver
Brookings	Grants Pass	Longview			

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time-best road) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all other project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

Prevailing Wage Rate Laws Handbook

The 2022 edition of the ***Prevailing Wage Rate Laws Handbook*** is now available on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage.aspx.

In addition to providing this and other PWR publications, Oregon BOLI Labor & Industries' PWR Unit regularly offers free, informational seminars for both public agencies and contractors. The current schedule is available online at https://www.oregon.gov/boli/employers/Pages/prevailing-wage-seminars.aspx.

If you are interested in being included on our mailing lists for future seminar notifications, please contact us at PWR.Email@boli.oregon.gov or (971) 353-2416.

"General Decision Number: OR20220077 02/25/2022

Superseded General Decision Number: OR20210077

State: Oregon

Construction Type: Heavy

County: Umatilla County in Oregon.

HEAVY CONSTRUCTION PROJECTS.

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022;	Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2022.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022.	Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at https://www.dol.gov/agencies/whd/government-contracts.

Modification Number	Publication Date
0	01/07/2022
1	02/18/2022
2	02/25/2022

CARP0001-038 06/01/2020

	Rates	Fringes
CARPENTER (Excluding Form Work)	$ 41.75	18.30
MILLWRIGHT	$ 43.26	18.75

ELEC0112-004 06/01/2021

	Rates	Fringes
ELECTRICIAN	$ 50.00	22.93

ENGI0701-040 01/01/2020

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 45.90	15.35
GROUP 1A	$ 48.06	15.35
GROUP 1B	$ 50.22	15.35
GROUP 2	$ 43.99	15.35
GROUP 3	$ 42.84	15.35
GROUP 4	$ 41.01	15.35
GROUP 5	$ 39.77	15.35
GROUP 6	$ 36.55	15.35

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: CRANE: Helicopter Operator, when used in erecting work; Whirley Operator, 90 ton and over; LATTICE BOOM CRANE: Operator 200 tons through 299 tons, and/or over 200 feet boom; HYDRAULIC CRANE: Hydraulic Crane Operator 90 tons through 199 tons with luffing or tower attachments;

GROUP 1A: HYDRAULIC CRANE: Hydraulic Operator, 200 tons and over (with luffing or tower attachment); LATTICE BOOM CRANE: Operator, 200 tons through 299 tons, with over 200 feet boom;

GROUP 1B: LATTICE BOOM CRANE: Operator, 300 tons through 399 tons with over 200 feet boom; Operator 400 tons and over

GROUP 2: CRANE: Cableway Operator, 25 tons and over; HYDRAULIC CRANE: Hydraulic crane operator 90 tons through 199 tons (without luffing or tower attachment);

TOWER/WHIRLEY OPERATOR: Tower Crane Operator; Whirley Operator, under 90 tons; LATTICE BOOM CRANE: 90 through 199 tons and/or 150 to 200 feet boom; HYDRAULIC CRANE: Hydraulic crane operator, 50 tons through 89 tons (with luffing or tower attachment); Rubber tired scraper with tandom scrapers; Loader 120,000 lbs and above; BLADE: Auto Grader; Blade Operator-Robotic; Bulldozer over 120,000 lbs and above;

GROUP 3: HYDRAULIC CRANE: Hydraulic crane operator, 50 tons through 89 tons (without luffing or tower attachment); LATTICE BOOM CRANES: Lattice Boom Crane-50 through 89 tons (and less than 150 feet boom); Rubber Tired Scraper: with tandom scrapers; self loading, paddle wheel, auger type, finish and/or 2 or more units; Loader 60,000 lbs and less than 120,000 lbs; Bulldozer over 70,000 lbs up to and including 120,000 lbs;

GROUP 4: CRANE: Hydraulic Crane Operator, under 50 tons; LATTICE BOOM CRANE OPERATOR: Lattice Boom Crane Operator, under 50 tons; TRACKHOE/BACKHOE-ROBOTIC: track and wheel type, up to and including 20,0000 lbs. with any or all attachments; BLADE: Blade Operator; Tractor operator with boom attachment; DRILLING: Churm Drill and Earth Boring Machine Operator; Directional Drill Operator over 20,000 lbs pullback; CRANE: Chicago boom and similar types; Boom type lifting device, 5 ton capacity or less; Rubber-Tired Scraper, single engine, single scraper; Compactor-Self Propelled; Loaders 25,000 lbs and less than 60,000 lbs; Bulldozer over 20,000 lbs and more than 100 horse up to 70,000 lbs; Screed; Compactor with blade; Mechanic

GROUP 5: TRACKHOE/BACKHOE HYDRAULIC: Track type up to and including 20,000 lbs, Wheel type (Ford, John Deer, Case Type); Boom truck operator; DRILLING: Churm Drill and Earth Boring Machine Operator; Directional Drill Operator less than 20,000 lbs pullback; Loaders, rubber tired type , less than 25,00 lbs; Forklift over 5 ton, Bulldozer 20,000 lbs or 100 horses or less; Roller; Compactor without blade

GROUP 6: LOADERS: (less than 1 cu yd.); Oiler; Grade Checker; Crane oiler; Forklift; Roller (non-asphalt)

Zone Differential (add to Zone 1 rates):
Zone 2 - $3.00
Zone 3 - $6.00

For the following metropolitan counties: MULTNOMAH;

CLACKAMAS; MARION; WASHINGTON; YAMHILL; AND COLUMBIA; CLARK; AND COWLITZ COUNTY, WASHINGTON WITH MODIFICATIONS AS INDICATED:

All jobs or projects located in Multnomah, Clackamas and Marion Counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Highway 26 and West of Mile Post 30 on Highway 22 and all jobs or projects located in Yamhill County, Washington County and Columbia County and all jobs or porjects located in Clark & Cowlitz County, Washington except that portion of Cowlitz County in the Mt. St. Helens ""Blast Zone"" shall receive Zone I pay for all classifications.

All jobs or projects located in the area outside the identified boundary above, but less than 50 miles from the Portland City Hall shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone III pay for all classifications.

For the following cities: ALBANY; BEND; COOS BAY; EUGENE; GRANTS PASS; KLAMATH FALLS; MEDFORD; ROSEBURG

All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone I pay for all classifications.

All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone III pay for all classifications.

IRON0029-013 01/03/2022

	Rates	Fringes
IRONWORKER (Reinforcing and Structural).....	$ 41.13	30.72

LABO0737-005 06/01/2020

	Rates	Fringes
Laborers: (Mason Tender-Cement/Concrete).....	$ 32.71	15.40

LABO0737-031 06/01/2021

	Rates	Fringes
Laborers:		
GROUP 1.....	$ 33.48	16.23
GROUP 2.....	$ 34.71	16.23

LABORER CLASSIFICATIONS

GROUP 1: Asphalt Spreader

GROUP 2: Grade Checker

PAIN0055-022 07/01/2020

	Rates	Fringes
PAINTER		
BRUSH, ROLLER AND SPRAY.....	$ 25.94	13.34

PLUM0598-007 06/01/2019

	Rates	Fringes
Plumbers and Pipefitters.....	$ 50.47	32.17

SUOR2009-075 11/23/2009

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 23.50	9.27
CEMENT MASON/CONCRETE FINISHER...	$ 21.13	8.90
LABORER: Common or General.....	$ 21.05	4.38
LABORER: Fence Erection.....	$ 23.88	7.45

LABORER: Flagger.....$ 19.31 5.31

LABORER: Pipelayer.....$ 20.52 4.51

LINE CONSTRUCTION: Groundman....$ 31.36 7.27

OPERATOR: Bobcat/Skid
Steer/Skid Loader.....$ 22.77 7.90

OPERATOR: Broom/Sweeper.....$ 32.31 6.43

OPERATOR: Excavator.....$ 30.12 6.23

OPERATOR: Paver (Asphalt,
Aggregate, and Concrete).....$ 27.59 2.96

TRUCK DRIVER: Dump Truck.....$ 23.79 5.95

TRUCK DRIVER: Off the Road
Truck.....$ 31.81 6.33

TRUCK DRIVER: Water Truck.....$ 26.12 6.53

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.

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) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage

determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local),
a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which 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. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1,2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and
non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates
the State of Louisiana. 2012 is the year of 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. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the
classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in
the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

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

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write 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 the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator
(See 29 CFR Part 1.8 and 29 CFR Part 7). Write 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 by 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

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

"General Decision Number: OR20220001 02/25/2022

Superseded General Decision Number: OR20210001

State: Oregon

Construction Type: Highway

Counties: Oregon Statewide.

HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022;	Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2022.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022.	Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at https://www.dol.gov/agencies/whd/government-contracts.

Modification Number	Publication Date
0	01/07/2022
1	01/28/2022
2	02/18/2022
3	02/25/2022

BROR0001-006 06/01/2020

BAKER, BENTON (NORTH), CLACKAMAS, CLATSOP, COLUMBIA, GILLIAM, HARNEY, HOOD RIVER, LINCOLN (NORTH), LINN (NORTH), MALHEUR (NORTH), MARION, MORROW, MULTNOMAH, POLK, SHERMAN, TILLAMOOK, UMATILLA, UNION, WALLOWA, WASCO (NORTH), WASHINGTON AND YAMHILL COUNTIES

	Rates	Fringes
BRICKLAYER	$ 41.20	22.39

BROR0001-007 06/01/2020

BENTON (SOUTH), CROOK, DESCHUTES, GRANT, JACKSON, JEFFERSON, KLAMATH, LAKE, LANE, LINCOLN (SOUTH), LINN (SOUTH), MALHEUR (SOUTH), WASCO (SOUTH) AND WHEELER COUNTIES

	Rates	Fringes
BRICKLAYER	$ 41.20	22.39

CARP9001-001 06/01/2020

ZONE 1:

	Rates	Fringes
Carpenters:		
CARPENTERS	$ 42.31	18.30
DIVER STANDBY	$ 53.37	18.30
DIVERS TENDERS	$ 47.14	18.30
DIVERS	$ 91.14	18.30
MANIFOLD AND/OR DECOMPRESSION CHAMBER OPERATORS	$ 47.14	18.30
MILLWRIGHTS	$ 43.26	18.30
PILEDRIVERS	$ 42.87	18.30

DEPTH PAY:
50 to 100 feet $2.00 per foot over 50 feet
101 to 150 feet 3.00 per foot over 50 feet

151 to 200 feet 4.00 per foot over 50 feet
over 220 feet 5.00 per foot over 50 feet

Zone Differential (Add to Zone 1 rates):
Zone 2 - $1.25
Zone 3 - 1.70
Zone 4 - 2.00
Zone 5 - 3.00
Zone 6 - 5.00
Zone 7 - 10.00

ZONE 1 - All jobs or projects located within 30 miles of the respective City Hall

ZONE 2 - More than 30 miles and less than 40 miles from the respective City Hall

ZONE 3 - More than 40 miles and less than 50 miles from the respective City Hall

ZONE 4 - More than 50 miles and less than 60 miles from the respective City Hall

ZONE 5 - More than 60 miles and less than 70 miles from the respective City Hall

ZONE 6 - More than 70 miles from the respective City Hall.

ZONE 7 - More than 100 miles from the respective City Hall.

BASEPOINTS CITIES FOR CARPENTERS (EXCLUDING MILLWRIGHTS, PILEDRIVERS AND DIVERS)

ALBANY ASTORIA BAKER
BEND BROOKINGS BURNS
COOS BAY CORVALLIS EUGENE
GOLDENDALE GRANTS PASS HERMISTON
HOOD RIVER KLAMATH FALLS LAGRANDE
LAKEVIEW LONGVIEW MADRAS
MEDFORD McMINNVILLE NEWPORT
OREGON CITY ONTARIO PENDLETON
PORTLAND PORT ORFORD REEDSPORT
ROSEBURG SALEM ST. HELENS
THE DALLES TILLAMOOK VANCOUVER

BASEPOINTS FOR MILLWRIGHTS

EUGENE NORTH BEND LONGVIEW
PORTLAND MEDFORD THE DALLES
VANCOUVER

BASEPOINTS FOR PILEDRIVERS AND DIVERS

ASTORIA BEND COOS BAY
EUGENE KLAMATH FALLS LONGVIEW
MEDFORD NEWPORT PORTLAND
ROSEBURG SALEM THE DALLES

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* ELEC0048-006 01/01/2021

CLACKAMAS, CLATSOP, COLUMBIA, HOOD RIVER, MULTNOMAH, TILLAMOOK, WASCO, WASHINGTON, SHERMAN AND YAMHILL (NORTH) COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 44.22	21.50
ELECTRICIAN	$ 50.35	25.48

HOURLY ZONE PAY:

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Portland, The Dalles, Hood River, Tillamook, Seaside and Astoria

Zone Pay:
Zone 1: 31-50 miles $1.50/hour
Zone 2: 51-70 miles $3.50/hour
Zone 3: 71-90 miles $5.50/hour
Zone 4: Beyond 90 miles $9.00/hour

*These are not miles driven. Zones are based on Delorrne Street Atlas USA 2006 plus.

ELEC0112-001 06/01/2021

BAKER, GILLIAM, GRANT, MORROW, UMATILLA, UNION, WALLOWA, AND WHEELER COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 52.50	23.01

ELECTRICIAN.....$ 50.00 22.93

ELEC0280-003 01/01/2022

BENTON, CROOK, DESCHUTES, JEFFERSON, LANE (EAST OF A LINE RUNNING NORTH AND SOUTH FROM THE NORTHEAST CORNER OF COOS COUNTY TO THE SOUTHEAST CORNER OF LINCOLN COUNTY), LINN, MARION, POLK AND YAMHILL (SOUTHERN HALF) COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 49.51	19.79
ELECTRICIAN	$ 49.36	20.20

ELEC0291-006 12/01/2021

MALHEUR COUNTY

	Rates	Fringes
CABLE SPLICER	$ 37.63	6%+15.40
ELECTRICIAN	$ 34.21	6%+15.40

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* ELEC0659-004 02/01/2019

DOUGLAS (EAST OF A LINE RUNNING NORTH AND SOUTH FROM THE NE CORNER OF COOS COUNTY TO THE SE CORNER OF LINCOLN COUNTY), HARNEY, JACKSON, JOSEPHINE, KLAMATH AND LAKE COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 59.09	20.22
ELECTRICIAN	$ 35.19	16.80

ZONE PAY: BASE POINTS ARE FROM THE DOWNTOWN POST OFFICE IN GRANTS PASS, KLAMATH FALLS, ROSEBURG AND MEDFORD.

ZONE 1:	0-20 MILES	$0.00 PER HOUR
ZONE 2:	> 20-30 MILES	$1.50 PER HOUR
ZONE 3:	>30-40 MILES	$3.30 PER HOUR
ZONE 4:	>40-50 MILES	$5.00 PER HOUR
ZONE 5:	>50-60 MILES	$6.80 PER HOUR
ZONE 6:	>60 MILES	$9.50 PER HOUR

*THESE ARE NOT MILES DRIVEN. zONES ARE BASED ON DELORNE STREET ATLAS USA 5.0.

ELEC0932-004 07/01/2021

COOS, CURRY, LINCOLN, DOUGLAS AND LANE COUNTIES (AREA LYING WEST OF A LINE NORTH AND SOUTH FROM THE N.E. CORNER OF COOS COUNTY TO THE S.E. CORNER OF LINCOLN COUNTY)

	Rates	Fringes
ELECTRICIAN	$ 42.12	21.61

ENGI0701-005 01/01/2020

ZONE 1:

POWER EQUIPMENT OPERATORS (See Footnote C)

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 45.90	15.35
GROUP 1A	$ 48.06	15.35
GROUP 1B	$ 50.22	15.35
GROUP 2	$ 43.99	15.35
GROUP 3	$ 42.84	15.35
GROUP 4	$ 41.01	15.35
GROUP 5	$ 39.77	15.35
GROUP 6	$ 36.55	15.35

Zone Differential (add to Zone 1 rates):
Zone 2 - $3.00
Zone 3 - $6.00

For the following metropolitan counties: MULTNOMAH; CLACKAMAS; MARION; WASHINGTON; YAMHILL; AND COLUMBIA; CLARK; AND COWLITZ COUNTY, WASHINGTON WITH MODIFICATIONS AS INDICATED:

All jobs or projects located in Multnomah, Clackamas and Marion Counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Highway 26 and West of Mile Post 30 on Highway 22 and all jobs or projects located in Yamhill County, Washington County and Columbia County and all jobs or porjects located in Clark & Cowlitz County, Washington except that portion of Cowlitz County in the Mt. St. Helens ""Blast Zone"" shall receive Zone I pay for all classifications.

All jobs or projects located in the area outside the identified boundary above, but less than 50 miles from the Portland City Hall shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone III pay for all classifications.

For the following cities: ALBANY; BEND; COOS BAY; EUGENE; GRANTS PASS; KLAMATH FALLS; MEDFORD; ROSEBURG
All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone I pay for all classifications.

All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone III pay for all classifications.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

Group 1
Concrete Batch Plan and or Wet mix three (3) units or more; Crane, Floating one hundred and fifty (150) ton but less than two hundred and fifty (250) ton; Crane, two hundred (200) ton through two hundred ninety nine (299) ton with two hundred foot (200') boom or less (including jib, inserts and/or attachments); Crane, ninety (90) ton through one hundred ninety nine (199) ton with over two hundred (200') boom Including jib, inserts and/or attachments); Crane, Tower Crane with one hundred seventy five foot (175') tower or less and with less than two hundred foot (200') jib; Crane, Whirley ninety (90) ton and over; Helicopter when used in erecting work

Group 1A
Crane, floating two hundred fifty (250) ton and over; Crane, two hundred (200) ton through two hundred ninety nine (299) ton, with over two hundred foot (200') boom (including jib, inserts and/or attachments); Crane, three hundred (300) ton through three hundred ninety nine (399) ton; Crane, Tower Crane with over one hundred seventy five foot (175') tower or over two hundred foot (200') jib; Crane, tower Crane on rail system or 2nd tower or more in work radius

Group 1B

Crane, three hundred (300) ton through three hundred ninety nine (399) ton, with over two hundred foot (200') boom (including jib, inserts and/or attachments); Floating crane, three hundred fifty (350) ton and over; Crane, four hundred (400) ton and over

Group 2

Asphalt Plant (any type); Asphalt Roto-Mill, pavement profiler eight foot (8') lateral cut and over; Auto Grader or ""Trimmer""; Blade, Robotic; Bulldozer, Robotic Equipment (any type); Bulldozer, over one hundred twenty thousand (120,000) lbs. and above; Concrete Batch Plant and/or Wet Mix one (1) and two (2) drum; Concrete Diamond Head Profiler; Canal Trimmer; Concrete, Automatic Slip Form Paver (Assistant to the Operator required); Crane, Boom Truck fifty (50) ton and with over one hundred fifty foot (150') boom and over; Crane, Floating (derrick barge) thirty (30) ton but less than one hundred fifty (150) ton; Crane, Cableway twenty-five (25) ton and over; Crane, Floating Clamshell three (3) cu. Yds. And over; Crane, ninety (90) ton through one hundred ninety nine (199) ton up to and including two hundred foot (200') of boom (including jib inserts and/or attachments); Crane, fifty (50) ton through eighty nine (89) ton with over one hundred fifty foot (150') boom (including jib inserts and/or attachments); Crane, Whirley under ninety (90) ton; Crusher Plant; Excavator over one hundred thirty thousand (130,000) lbs.; Loader one hundred twenty thousand (120,000) lbs. and above; Remote Controlled Earth Moving Equipment; Shovel, Dragline, Clamshell, five (5) cu. Yds. And over; Underwater Equipment remote or otherwise, when used in construction work; Wheel Excavator any size

Group 3

Bulldozer, over seventy thousand (70,000) lbs. up to and including one hundred twenty thousand (120,000) lbs.; Crane, Boom Truck fifty (50) ton and over with less than one hundred fifty foot (150') boom; Crane, fifty (50) ton through eighty nine (89) ton with one hundred fifty foot (150') boom or less (including jib inserts and/or attachments); Crane, Shovel, Dragline or Clamshell three (3) cu. yds. but less than five (5) cu. Yds.; Excavator

over eighty thousand (80,000) lbs. through one hundred thirty thousand (130,000) lbs.; Loader sixty thousand (60,000) lbs. and less than one hundred twenty thousand (120,000) lbs.

Group 4

Asphalt, Screed; Asphalt Paver; Asphalt Roto-Mill, pavement profiler, under eight foot (8') lateral cut; Asphalt, Material Transfer Vehicle Operator; Back Filling Machine; Backhoe, Robotic, track and wheel type up to and including twenty thousand (20,000) lbs. with any attachments; Blade (any type); Boatman; Boring Machine; Bulldozer over twenty thousand (20,000) lbs. and more than one hundred (100) horse up to seventy thousand (70,000) lbs.; Cable-Plow (any type); Cableway up to twenty five (25) ton; Cat Drill (John Henry); Chippers; Compactor, multi-engine; Compactor, Robotic; Compactor with blade self-propelled; Concrete, Breaker; Concrete, Grout Plant; Concrete, Mixer Mobile; Concrete, Paving Road Mixer; Concrete, Reinforced Tank Banding Machine; Crane, Boom Truck twenty (20) ton and under fifty (50) ton; Crane, Bridge Locomotive, Gantry and Overhead; Crane, Carry Deck; Crane, Chicago Boom and similar types; Crane, Derrick Operator, under one hundred (100) ton; Crane, Floating Clamshell, Dragline, etc. Operator, under three (3) cu. yds. Or less than thirty (30) ton; Crane, under fifty (50) ton; Crane, Quick Tower under one hundred foot (100') in height and less than one hundred fifty foot (150') jib (on rail included); Diesel-Electric Engineer (Plant or Floating); Directional Drill over twenty thousand (20,000) lbs. pullback; Drill Cat Operator; Drill Doctor and/or Bit Grinder; Driller, Percussion, Diamond, Core, Cable, Rotary and similar type; Excavator Operator over twenty thousand (20,000) lbs. through eighty thousand (80,000) lbs.; Generator Operator; Grade-all; Guardrail Machines, i.e. punch, auger, etc.; Hammer Operator (Piledriver); Hoist, stiff leg, guy derrick or similar type, fifty (50) ton and over; Hoist, two (2) drums or more; Hydro Axe (loader mounted or similar type); Jack Operator, Elevating Barges, Barge Operator, self-unloading; Loader Operator, front end and overhead, twenty five thousand (25,000) lbs. and less than sixty thousand (60,000) lbs.; Log Skidders; Piledriver Operator (not crane type); Pipe, Bending, Cleaning, Doping and Wrapping

Machines; Rail, Ballast Tamper Multi-Purpose; Rubber-tired Dozers and Pushers; Scraper, all types; Side-Boom; Skip Loader, Drag Box; Strump Grinder (loader mounted or similar type); Surface Heater and Planer; Tractor, rubber-tired, over fifty (50) HP Flywheel; Trenching Machine three foot (3') depth and deeper; Tub Grinder (used for wood debris); Tunnel Boring Machine Mechanic; Tunnel, Mucking Machine; Ultra High Pressure Water Jet Cutting Tool System Operator; Vacuum Blasting Machine Operator; Water pulls, Water wagons

Group 5

Asphalt, Extrusion Machine; Asphalt, Roller (any asphalt mix); Asphalt, Roto-Mill pavement profiler ground man; Bulldozer, twenty thousand (20,000) lbs. or less, or one hundred (100) horse or less; Cement Pump; Chip Spreading Machine; Churn Drill and Earth Boring Machine; Compactor, self-propelled without blade; Compressor, (any power) one thousand two hundred fifty (1,250) cu. ft. and over, total capacity; Concrete, Batch Plant Quality control; Concrete, Combination Mixer and compressor operator, gunite work; Concrete, Curb Machine, Mechanical Berm, Curb and/or Curb and Gutter; Concrete, Finishing Machine; Concrete, Grouting Machine; Concrete, Internal Full Slab Vibrator Operator; Concrete, Joint Machine; Concrete, Mixer single drum, any capacity; Concrete, Paving Machine eight foot (8') or less; Concrete, Planer; Concrete, Pump; Concrete, Pump Truck; Concrete, Pumpcrete Operator (any type); Concrete, Slip Form Pumps, power driven hydraulic lifting device for concrete forms; Conveyored Material Hauler; Crane, Boom Truck under twenty (20) tons; Crane, Boom Type lifting device, five (5) ton capacity or less; Drill, Directional type less than twenty thousand (20,000) lbs. pullback; Fork Lift, over ten (10) ton or Robotic; Helicopter Hoist; Hoist Operator, single drum; Hydraulic Backhoe track type up to and including twenty thousand (20,000) lbs.; Hydraulic Backhoe wheel type (any make); Laser Screed; Loaders, rubber-tired type, less than twenty five thousand (25,000) lbs.; Pavement Grinder and/or Grooving Machine (riding type); Pipe, cast in place Pipe Laying Machine; Pulva-Mixer or similar types; Pump Operator, more than five (5) pumps (any size); Rail, Ballast Compactor, Regulator, or Tamper machines; Service Oiler (Greaser); Sweeper Self-Propelled; Tractor, Rubber-Tired, fifty (50) HP flywheel and under;

Trenching Machine Operator, maximum digging capacity three foot (3') depth; Tunnel, Locomotive, Dinkey; Tunnel, Power Jumbo setting slip forms, etc.

Group 6

Asphalt, Pugmill (any type); Asphalt, Raker; Asphalt, Truck Mounted Asphalt Spreader, with Screed; Auger Oiler; Boatman; Bobcat, skid steed (less than one (1) yard); Broom, self-propelled; Compressor Operator (any power) under 1,250 cu. ft. total capacity; Concrete Curing Machine (riding type); Concrete Saw; Conveyor Operator or Assistant; Crane, Tugger; Crusher Feederman; Crusher Oiler; Deckhand; Drill, Directional Locator; Fork Lift; Grade Checker; Guardrail Punch Oiler; Hydrographic Seeder Machine, straw, pulp or seed; Hydrostatic Pump Operator; Mixer Box (CTB, dry batch, etc.); Oiler; Plant Oiler; Pump (any power); Rail, Brakeman, Switchman, Motorman; Rail, Tamping Machine, mechanical, self-propelled; Rigger; Roller grading (not asphalt); Truck, Crane Oiler-Driver

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IRON0029-004 01/03/2022

	Rates	Fringes
IRONWORKER	$ 41.13	30.72

LABO0737-001 06/01/2020

	Rates	Fringes
Mason Tender/Hod Carrier Tenders to Bricklayers, Tile Setters, Marble Setters and Terrazzo Workers, Topping for Cement Finishers and Mortar Mixers	$ 32.71	15.40

LABO0737-008 06/01/2021

ZONE 1:

LABORERS (SEE FOOTNOTE C)

	Rates	Fringes
Laborers:		
GROUP 1	$ 33.48	16.23
GROUP 2	$ 34.71	16.23
GROUP 3	$ 29.04	16.23

Zone Differential (Add to Zone 1 rates):
Zone 2 - $0.85
Zone 3 - 2.00
Zone 4 - 3.00
Zone 5 - 5.00

ZONE 1 - All jobs or projects located within 30 miles of the respective City Hall

ZONE 2 - More than 30 miles and less than 40 miles from the respective City Hall

ZONE 3 - More than 40 miles and less than 50 miles from the respective City Hall

ZONE 4 - More than 50 miles and less than 80 miles from the respective City Hall

ZONE 5 - More than 80 miles from the respective City Hall.

BASEPOINTS:
ALBANY ASTORIA BAKER CITY
BEND BURNS COOS BAY
EUGENE GRANTS PASS HERMISTON
KLAMATH FALLS MEDFORD PENDLETON
PORTLAND ROSEBURG SALEM
THE DALLES

LABORER CLASSIFICATIONS

GROUP 1: Applicator (including Pot Tender for same) applying protective material by hand or nozzle on utility lines or storage tanks on project, Asphalt Plant; Asphalt Spreader; Batch Weighman; Broomers; Brush Burners and Cutters; Choker Setter; Choker Splicer; Clary Power Spreader; Clean-up Laborer; Clean up Nozzleman (concrete, rock, etc); Concrete Laborer; Crusher Feeder; Curing, Concrete; Demolition, wrecking, and moving; Dopping and Wrapping Pipe; Dumpman (for Grading Crew); Erosion Control

Specialist; Fine Graders; Fence Builders; Form Strippers; Guard Rail, Median Rail, Barriers, Reference Post, Guide Post, Right of Way Marker; Remote Control (Dry Pack Machine, Jackhammer, Chipping Guns, Compaction, Paving Breakers, Hand Held Concrete Saw, Demo Saw, Core Drill); Precast Concrete Setter; Pressure Washer; Railroad Track Laborer; Ribbon Setter; Rip Rap Map; Sand Blasting (Wet); Scaffold Tender; Self Propelled Concrete Buggy; Sewer Laborer; Sign Erector; Signalman; Scissor and Manlift; Skipman; Slopers; Sprayman; Stake Chaser; Stake Setter; Tamper; Timber Faller and Bucker; Tool Operators (Hand Held, Walk Behind)

GROUP 2: Asbestos Removal; Asphalt Rakers, Bit Grinder, Concrete Core Drill, Concrete Pump Nozzleman, Concrete Saw Operator (Walk Behind, Walk Saw, Rail Mounted, Wire); Drill Operator; Grade Checker; Gunite Nozzleman; Hazardous Waste Laborer; High Scalers; Laser Bean (Pipe Laying); Loop Installation; Manhole Builder; Mold Remediation Laborer; Nippers and Timberman; Pipelayer; Powderman; Power Saw Operators (Bucking and Falling); Pumpcrete Nozzleman; Sand Blasting (Dry); Sewer Timberman; Tugger Operator; Vibrators; Water Blaster

GROUP 3: Final Clean-up(detailed clean-up, limited to cleaning up floors, ceilings, walls, windows-prior to acceptance by the owner); Fire Watch; Landscaper; Traffic Flagger

FOOTNOTE C:

HANDLING OF HAZARDOUS WAST MATERIALS - Personnel in all craft classifications subject to working inside a federally designated Hazardous Waste perimeter shall be eligible for compensation in accordance with the following group schedule relative to the level of Hazardous Waste as outline in the specific Hazardous Waste Project Site Safety Plan:

H-1 Base Wage Rate when on a hazardous waste site when not outfitted with protective clothing.

H-2 Class ""C"" Suit - Basic hourly wage rate plus $1.00 per hour, fringes plus $0.15.

H-3 Class ""B"" Suit - Basic hourly wage rate plus $1.50 per hour, fringes plus $0.15.

H-4 Class ""A"" Suit -Basic hourly wage rate plus $2.00 per hour, fringes plus $0.15.

PAIN0055-002 07/01/2019

	Rates	Fringes
PAINTER		
HIGHWAY & PARKING LOT		
STRIPER	$ 35.45	12.56

PAIN0055-033 07/01/2020

	Rates	Fringes
PAINTER		
Area 1: CLACKAMAS, CLATSOP, COLUMBIA, GILLIAM, HOOD RIVER, MARION, MULTNOMAH, MORROW, POLK, SHERMAN, TILLAMOOK, UMATILLA, UNION, WALLOWA, WASCO, WASHINGTON, and YAMHILL Counties		
Painters	$ 27.14	13.34
Area 2: BAKER, BENTON, CROOK, DESCHUTES, GRANT, HARNEY, JEFFERSON, LAKE, LANE, LINN, LINCOLN, MALHEUR, and WHEELER Counties		
Painters	$ 24.14	13.34
Area 3: COOS, CURRY, DOUGLAS, JACKSON, JOSEPHINE, and KLAMATH Counties		
Painters	$ 22.14	13.34

All high work over 60 ft. = base rate + $0.75

PLAS0555-001 07/01/2020

ZONE 1:

	Rates	Fringes
Cement Masons: (ZONE 1)		
CEMENT MASONS DOING BOTH COMPOSITION/POWER MACHINERY AND SUSPENDED/HANGING SCAFFOLD	$ 37.32	19.42
CEMENT MASONS ON SUSPENDED, SWINGING AND/OR HANGING SCAFFOLD	$ 36.58	19.42
CEMENT MASONS	$ 35.52	19.42

COMPOSITION WORKERS AND POWER MACHINERY OPERATORS...$ 36.58 19.42

Zone Differential (Add To Zone 1 Rates):
Zone 2 - $0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 3.00

BASE POINTS: BEND, CORVALLIS, EUGENE, MEDFORD, PORTLAND, SALEM, THE DALLES, VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall

ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.

ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.

ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.

ZONE 5: More than 80 miles from the respective city hall

TEAM0037-004 06/01/2020

ZONE 1:

TRUCK DRIVERS (See Footnote C):

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 29.08	16.40
GROUP 2	$ 29.20	16.40
GROUP 3	$ 29.34	16.40
GROUP 4	$ 29.62	16.40
GROUP 5	$ 29.85	16.40
GROUP 6	$ 30.03	16.40
GROUP 7	$ 30.24	16.40

Zone Differential (add to Zone 1 rates):
Zone 2 - $0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 2.75

Zone 1 - All jobs or projects located within 30 miles of the respective City Hall

Zone 2 - More than 30 miles and less than 40 miles from the respective City Hall

Zone 3 - More than 40 miles and less than 50 miles from the respective City Hall

Zone 4 - More than 50 miles and less than 80 miles from the respective City Hall

Zone 5 - More than 80 miles from the respective City Hall

BASEPOINTS:

ALBANY	ASTORIA	BAKER
BEND	BINGEN	BROOKINGS
BURNS	COOS BAY	CORVALLIS
EUGENE	GOLDENDALE	GRANTS PASS
HERMISTON	HOOD RIVER	KLAMATH FALLS
LAGRANDE	LAKEVIEW	LONGVIEW
MADRAS	MEDFORD	MCMINNVILLE
OREGON CITY	NEWPORT	ONTARIO
PENDLETON	PORTLAND	PORT ORFORD
REEDSPORT	ROSEBURG	SALEM
THE DALLES	TILLAMOOK	VANCOUVER

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: A-frame or hydra-lift truck w/load bearing surface; Articulated dump truck; Battery rebuilders; Bus or manhaul driver; Concrete buggies (power operated); Concrete pump truck; Dump trucks, side, end and bottom dumps, including semi-trucks and trains or combinations thereof: up to and including 10 cu. yds.; Lift jitneys, fork lifts (all sizes in loading, unloading and transporting material on job site); Loader and/or leverman on concrete dry batch plant (manually operated); Lubrication man, fuel truck driver, tireman, wash rack, steam cleaner or combination; Pilot car; Pickup truck; Slurry truck driver or leverman; Solo flat bed and misc. body truck, 0-10 tons; Team drivers; Tireman; Transit mix and wet or dry mix trucks: 5 cu yds. and under; Water wagons (rated capacity) up to 3,000 gallons

GROUP 2: Boom truck/hydra-lift or retracting crane; Challenger; Dumpsters or similar equipment-all sizes; Dump trucks/articulated dumps 6 cu to 10 cu.; Flaherty spreader

driver or leverman; Low bed equipment, flat bed semi-truck and trailer or doubles transporting equipment or wet or dry materials; Lumber carrier, driver-straddle carrier (used in loading, unloading and transporting of materials on job site); Oil distributor driver or leverman; Transit mix and wet or dry mix trucks: over 5 cy yds and including 7 cu. yds; Vacuum trucks; Water Wagons (rated capacity) over 3,000 to 5,000 gallons

GROUP 3: Ammonia nitrate distributor driver; Dump trucks, side, end and bottom dumps, including semi-trucks and trains or combinations thereof: over 10 cu. yds. and including 30 cu. yds., includes articulated dump trucks; Self-Propelled street sweeper; Transit mix and wet or dry mix trucks, over 7 cu. yds. and including 11 cu. yds.; truck mechanic-Welder-Body repairman; Utility and clean-up truck; Water wagons (rated capacity) 5,000 to 10,000 gallons.

GROUP 4: Asphalt Bruner; Dump trucks, side, end and bottom dumps, including semi-trucks and trains or combinations thereof: over 30 cu. yds. and including 50 cu. yds. includes articulated dump trucks; Fire guard; Transit Mix and Wet or Dry Mix Trucks, over 11 cu. yds. and including 15 cu. yds.; Water Wagon (rated capacity) over 10,000 gallons to 15,000 gallons

GROUP 5: Composite Crewman; Dump trucks, side, end and bottom dumps, including semi-trucks and trains or combinations thereof: over 50 cu. yds. and including 60 cu. yds., includes articulated dump trucks

GROUP 6: Bulk cement spreader w/o auger; Dry Pre-Batch concrete mix trucks; Dump trucks, side, end and bottom dumps, including semi-trucks and trains of combinations thereof: over 60 cu. yds. and including 80 cu. yds. and includes articulated dump trucks; Skid truck

GROUP 7: Dump trucks, side, end and bottom dumps, including semi-trucks and trains or combinations thereof: over 80 cu. yds. and including 100 cu. yds. includes articulated dump trucks; Industrial lift truck (mechanical tailgate)

FOOTNOTE C:

HANDLING OF HAZARDOUS WAST MATERIALS -(LABORERS, POWER EQUIPMENT OPERATORS, AND TRUCK DRIVERS): Personnel in all craft classifications subject to working inside a federally designated Hazardous Waste perimeter shall be eligible for compensation in accordance with the following group schedule relative to the level of Hazardous Waste as outline in the specific Hazardous Waste Project Site Safety Plan:

H-1 Base Wage Rate when on a hazardous waste site when not outfitted with protective clothing.

H-2 Class ""C"" Suit - Basic hourly wage rate plus $1.00 per hour, fringes plus $0.15.

H-3 Class ""B"" Suit - Basic hourly wage rate plus $1.50 per hour, fringes plus $0.15.

H-4 Class ""A"" Suit -Basic hourly wage rate plus $2.00 per hour, fringes plus $0.15.

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* SUOR1991-003 04/01/1991

	Rates	Fringes
Timber Sales Roads:		
LABORERS	$ 8.35 **	4.30
OPERATING ENGINEERS	$ 10.37 **	4.15
POWER SAW, DRILLER, POWDERMAN	$ 9.12 **	4.30
TEAMSTERS	$ 9.74 **	3.74

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

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($15.00) or 13658 ($11.25). Please see the Note at the top of the wage determination for more information.

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.

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) (ii)).

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

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which 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. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1,2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of 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. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

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

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write 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 the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write 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 by 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

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

SECTION VII

GEOTECHNICAL REPORTS

Geotechnical Investigation
Eastern Oregon Regional Airport
Pendleton Runway 29 Reconfiguration

Pendleton, Oregon

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1 INTRODUCTION

As requested, GRI completed a geotechnical investigation in association with the proposed project at the Eastern Oregon Regional Airport in Pendleton, Oregon. The Vicinity Map, Figure 1, shows the site location. This report provides a summary of our investigation, which included subsurface explorations, field and laboratory testing, and development of geotechnical design and construction recommendations.

2 PROJECT DESCRIPTION

Improvements are planned at the Eastern Oregon Regional Airport (PDT) that include relocating the Runway 29 threshold at the southeast end of the runway. Additional items include removing or replacing the associated connector taxiways (e.g., Taxiways D and E) and the adjacent holding apron. The Site Plan, Figure 2, includes an aerial image of the existing facilities. Precision Approach Engineering, Inc. (PAE) also provided a figure titled Conceptual Layout Runway 29, dated March 2021, showing the existing facilities and the proposed new layout of Runway 29 and the connector taxiways. The figure from PAE is attached to this report following Figure 2.

PAE is the prime engineering consultant for PDT and is providing civil and pavement design services. GRI personnel have completed investigations for previous projects with PAE at the airport. Relevant information from the previous work is referenced within this report as it relates to the current project.

3 SITE DESCRIPTION

3.1 General

Eastern Oregon Regional Airport is located northwest and uphill from Pendleton's city center on a relatively flat plateau. Among other facilities, the airport has two active runways, Runway 8-26 and Runway 11-29. The current project is located at the southeast end of Runway 11-29, northeast of the terminal building. The project area includes existing airside pavements. Outside the paved areas, the ground surface is covered with short grass or is gravel-surfaced.

3.2 Geology

Published geologic maps (e.g., Walker 1972 and Walker and MacLeod 1991) indicate the airport is underlain by loess (i.e., wind-blown silt and fine sand) followed by Columbia River Basalt. Local interbeds of hard and/or cemented soils known as caliche are present across the area, typically within a few feet to several feet below the ground surface. The mapped geology is generally consistent with the conditions observed within GRI's recent explorations discussed below.

4 SUBSURFACE CONDITIONS

4.1 General

Subsurface materials and conditions at the site were investigated on November 16, 2021, with eight drilled borings, designated B-1 through B-8. The approximate boring locations are shown on Figure 2. Borings B-1 through B-3 were completed in grass- or gravel-surfaced areas outside of the existing pavements and extended to depths ranging from about 3 feet to 11.5 feet below the ground surface. Practical drilling refusal was encountered in B-1 and B-2 at depths of about 11.3 feet and 3 feet, respectively. Borings B-4 through B-8 were completed in the existing pavement areas that include the runway, taxiways, and apron. The pavement borings typically extended to a depth of about 5 feet below the paved surface, except B-7, which encountered practical drilling refusal at about 3.5 feet.

The field and laboratory programs conducted to evaluate the physical engineering properties of the materials encountered in the explorations are described in Appendix A. Logs of the borings are provided on Figures 1A through 8A. A graphic representation of the pavement cores encountered in B-4 through B-8 is provided in Figure 9A. Photos of the pavement cores for borings B-4 through B-8 are provided on Figures 10A through 12A. A summary of pavement section thicknesses measured in the borings is provided in Table 1A. The terms and symbols used to describe the materials encountered in the explorations are defined in Table 4A and on the attached legend.

4.2 DCP Testing

Dynamic Cone Penetrometer (DCP) testing was completed in pavement borings B-4 through B-8 using a Kessler model DCP. The DCP test consists of driving the cone of the DCP apparatus into the soil and recording the penetration versus blow count (mm/blow) as the DCP value. The Oregon Department of Transportation (ODOT) and Federal Aviation Administration (FAA) provide correlations for estimating the in-situ resilient modulus from the DCP test results, which can also be correlated with California Bearing Ratio (CBR) values for the subgrade. Additional details of the DCP testing are provided in Appendix A. Logs of the DCP penetration versus depth are provided on Figures 13A through 18A, and a summary of the test results are provided in Table 2A.

4.3 Sampling

Disturbed soil samples were obtained from the borings at various depths, either by driving a split-spoon sampler at a selected depth interval or collecting drill cuttings. In borings B-1 through B-3, samples were obtained at 2.5-foot intervals by driving a split-spoon in conjunction with the Standard Penetration Test (SPT). The SPT N-values provide a measure of relative density of granular soils and the relative consistency or stiffness of cohesive soils. Additional details of the sampling and SPTs are provided in Appendix A. Bulk grab

samples were also obtained from B-1 and B-3 from a depth of about 0.5 feet to 2.5 feet. In the pavement borings (B-4 through B-8), grab samples of the aggregate base and subgrade were obtained from drill cuttings at selected depths.

4.4 Subsurface Conditions

For the purpose of discussion, the materials disclosed by our investigation have been grouped into the following categories based on their physical characteristics and engineering properties:

a. ASPHALT CONCRETE SURFACE COURSE
b. CEMENT-TREATED BASE
c. AGGREGATE BASE
d. SILT with trace to some sand or Sandy SILT

The following paragraphs provide a description of the units encountered in the explorations and a discussion of the groundwater conditions at the site.

a. ASPHALT CONCRETE SURFACE COURSE

The pavement borings (B-4 through B-8) encountered asphalt concrete (AC) surface course ranging in thickness from about 4½ inches to 14 inches. The thickest AC was measured in borings B-4 and B-8, completed within the existing runway and the adjacent holding apron, respectively. The thinnest AC was measured in boring B-7, located within the existing Taxiway E.

b. CEMENT-TREATED BASE

Cement-treated base (CTB) was encountered beneath the AC in boring B-5, extending from a depth of about 6 inches to 11½ inches. CTB was not encountered in the other current explorations. A previous exploration encountered CTB underlying Taxiway B, near the intersection of Runway 11-29 and Runway 8-26. Overall, the extent of the CTB appears to be limited across the site.

c. AGGREGATE BASE

Aggregate base was encountered in the pavement explorations, either directly beneath the AC (B-4, B-6, B-7, and B-8) or beneath the CTB (B-5). The aggregate base extended to depths ranging from about 11 inches to 25 inches below the pavement surface, with thicknesses ranging from about 4 inches to 11¾ inches. The aggregate base typically consists of 1- to 1.5-inch minus crushed gravel with variable silt content. The silt within the base aggregate is likely from migration and/or mixing with the underlying subgrade.

d. SILT with trace to some sand or Sandy SILT

Silt with variable sand content ranging from trace sand to sandy was encountered directly below the ground surface in borings B-1 through B-3 and at the subgrade level beneath the pavement sections in B-4 through B-8. The silt typically has low plasticity or is non-plastic. Drilling action in the explorations suggested the silt is typically medium stiff beneath the pavements. However, hard and/or cemented soil conditions were encountered in B-1 below about 7.5 feet, B-2 below about 2.5 feet, and B-7 below about 3 feet. As noted above, the cemented soil conditions are consistent with the caliche documented geologic mapping that includes the airport and surrounding areas. Other geotechnical investigations have also encountered similar conditions, as documented in previous reports to PAE.

4.5 Groundwater

No groundwater was encountered in the current explorations, nor do we have record of groundwater being encountered in previous explorations.

Shallow groundwater is likely not a typical condition at the airport, given the airport's location on a high plateau and the area's semi-arid climate with limited rainfall. Perched groundwater conditions may occur on occasion at shallow depths after heavy rain or snowstorm (or during snowmelt) due to the presence of cemented soils and relatively shallow bedrock beneath the site.

5 GEOTECHNICAL DESIGN AND CONSTRUCTION CONSIDERATIONS

5.1 General

We understand the project will include removing or decommissioning older pavements outside of the proposed reconfigured runway and taxiway alignment and constructing new pavements where necessary. The following provides recommendations for subgrade design parameters and construction associated with the proposed improvements.

5.2 Discussion of Subgrade Conditions

The subgrade typically consists of low plasticity to non-plastic silt with variable sand content that ranges from trace sand to sandy. A USCS classification ML is appropriate for this soil. Appendix A of the 2021 FAA Airport Pavement Design and Evaluation Advisory Circular (FAA AC No.: 150/5320-6G) indicates that soils designated as ML are "fair to good" as a foundation material when not subject to frost action and have "fair to poor" drainage characteristics. Frost-susceptibility and drainage are discussed in more detail in subsequent sections of this report.

Soils classified as ML are identified as having slight to medium shrink and swell potential. However, current and previous laboratory CBR tests have indicated volumetric swelling of

the soil to be less than 0.5%. Therefore, we do not believe mitigation for shrinking and swelling subgrade is warranted.

5.3 Subgrade Preparation and Parameters for New Pavement Design

The following recommendations are appropriate for the construction of new pavements.

5.3.1 Subgrade Design Parameters

Laboratory testing for the current project indicated a CBR value of 34.6 for the selected subgrade sample compacted to 95% relative compaction (based on ASTM D1557), as summarized in Table 3A and Figure 22A. Previous testing, also summarized in Table 3A, indicated CBR values for similar soils ranging from 15.4 to 29.2.

FAA generally recommends selecting a subgrade strength value for design that is one standard deviation below the mean value from laboratory testing. When including current and previous CBR test results, the mean value is approximately 24.2 and the standard deviation is 7.9. Therefore, the recommended design subgrade CBR value is 16.3. We believe this value is appropriate for the design of new pavements, provided the subgrade is prepared as recommended below.

5.3.2 Subgrade Preparation

Subgrade preparation for new pavements should follow the requirements for Item P-152 as summarized in the current FAA Standard Specifications for Construction of Airports (FAA AC No.: 150/5370-10H). We recommend the earthwork and compaction criteria assume cohesive soils (i.e., Plasticity Index (PI) > 3) as the PI value of the subgrade is somewhat variable.

The silt subgrade will be moisture sensitive and require careful moisture control for proper compaction. Therefore, we recommend compacting the subgrade at or slightly dry of optimum moisture to reduce the risk of pumping. Additionally, the moisture in the finished subgrade should be maintained and the subgrade should be backfilled with aggregate base and/or subbase courses as soon as practical to limit moisture fluctuations (i.e., wetting or drying).

The moisture-density test results indicate modest variability in the maximum dry density of the subgrade, even for similar soils (see Table 3A). We attribute this, in part, to the varying sand content of the subgrade. Therefore, additional testing may be required to bracket the range of expected conditions. In addition, some engineering judgment will be required during construction when confirming subgrade compaction.

Compaction of the subgrade will not be practical during wet weather conditions. Therefore, if construction during wet weather is necessary, it will likely require a thickened

aggregate base, subbase course, and/or granular stabilization fill to reduce the potential for subgrade disturbance. A minimum of 18 inches to 24 inches of granular fill over a separation geotextile placed on firm subgrade is typically required to limit the risk of subgrade pumping during construction. Alternatively, cement treatment may be used following Item P-156 (Cement Treated Subgrade) requirements in FAA AC No.: 150/5370-10H. For this option, a minimum cement application rate of about 3 percent of dry unit weight should be assumed. A reduced subgrade design strength (i.e., lower design subgrade CBR or resilient modulus value) will also be necessary if subgrade compaction is not feasible. In that case, we recommend defaulting to the recommended CBR and/or modulus values discussed below in Section 5.4.1.

5.4 Parameters for Evaluating Existing Pavements

We recommend the following for evaluating the existing pavements within the project area.

5.4.1 Subgrade Design Parameters

The in-situ DCP testing provides a means for evaluating the subgrade soil in its present condition beneath existing pavements. Available correlations with the current DCP test results indicated subgrade resilient moduli ranging from about 5,860 psi to 8,538 psi, with a mean value of about 7,120 psi and standard deviation of 1,190 psi (see Table 2A). Based on these results, we recommend using a design subgrade modulus value of 5,930 psi (or CBR value of about 4.0) to evaluate the existing subgrade conditions. Note the recommended in-situ subgrade strength is significantly lower compared to design strength based on laboratory CBR tests that assume subgrade compaction per FAA requirements.

5.4.2 Existing Base Aggregate

The existing base material consists primarily of crushed gravel but also includes variable quantities of silt and sand. Therefore, we recommend modeling it as Subbase Course (Item P-154) for analysis in FAARFIELD. The design should also consider the varying thickness of the existing base course across the project area.

5.4.3 Existing AC and CTB

FAARFIELD default material parameters for the AC (P-401/403) should be suitable for evaluating the surface course for possible overlay and/or milling and overlay options. However, any overlay evaluation must also take into consideration the thickness and wear of the existing AC. Figures 9A through 12A provide documentation of the AC conditions for the pavement cores retrieved from the explorations.

CTB was encountered in only one exploration (B-5) during the current phase of explorations. The full extent of CTB within the pavement sections is unknown but appears to be limited.

5.5 Frost Considerations

The subgrade consists of predominantly silt with corresponding USCS soil classification ML. An FG-4 FAA frost group classification is appropriate based on the classifications and recommendations in FAA AC No.: 150/5320-6G Table 2-2. FG-4 subgrade is considered highly frost-susceptible.

Complete mitigation of the risk of detrimental frost heave typically requires overexcavation and replacement of the frost-susceptible soils below the depth of frost penetration. The local building code in Umatilla County indicates a design frost penetration depth of 24 inches [referenced in Table R301.2(1) of the 2021 Oregon Residential Specialty Code (ORSC)].

As an alternative to complete frost protection, FAA provides an option for partial mitigation where the pavement section extends to at least 65% of the anticipated frost penetration depth. This corresponds to a structural section thickness of at least 16 inches. Providing drainage to prevent the accumulation of water in the subgrade is also beneficial to reduce the risk of frost heave.

5.6 Site Drainage

FAA AC 150/5320-6G, Appendix A, indicates soil classified as ML can have drainage characteristics ranging from fair to poor. The 2013 FAA Airport Drainage Design Advisory Circular (AC 150/5320-5D), Figure G-3, suggests coefficient of permeability, *k*, values in the range of 10^{-4} centimeters/second (cm/sec) to 10^{-8} cm/sec. The actual permeability will depend on multiple factors such as soil density and plasticity. Based on our experience with similar soils, we recommend assuming a *k* value no greater than 10^{-5} cm/sec for the silt subgrade. Infiltration testing may be performed to validate a higher *k* value.

5.7 General Construction Considerations

5.7.1 Construction Timing

As noted above, the soils that mantle the site are moisture sensitive. Therefore, it is our opinion earthwork can be completed most economically during the dry summer months, typically extending from June to mid-October. Regardless of the construction season, the contractor should anticipate wet soil conditions beneath existing pavements and allow ample time for drying where pavements are removed, exposing the underlying subgrade.

5.7.2 Fill Materials and Compaction

The base aggregate for new pavements should consist of well-graded gravel or crushed rock conforming to FAA P-208 or P-209 requirements, depending on the project specifications. Subbase should consist of free-draining sand, gravel, rock, asphalt grindings, or mixtures of the above that conform to FAA P-154 requirements and are free of plastic clay and organic matter.

Granular stabilization fill, if required to mitigate soft and/or overly wet soil conditions, should consist of 3-inch minus, clean (i.e., less than 5% passing the No. 200 sieve), well-graded, angular, crushed (quarry) rock. Stone Embankment Fill as defined in the Oregon Standards Specification for Construction; Section 00330.16 (ODOT 2021) may be specified with the alteration that a maximum particle size of 3 inches is required. The gradation of the Stabilization Fill meets the requirements for Subbase Course (Item P-154) and may be substituted for subbase where overexcavation is required. The percent fractured faces for the angular material should meet the requirements for Item P-208 or P-209 but may be confirmed by visual observation.

All fills should be placed in level lifts and compacted based on FAA requirements for the selected material type, as defined in FAA AC No.: 150/5370-10H. The moisture content of the fill should be adjusted to within about 2% of its optimum value prior to compaction. Field density tests should be run frequently to confirm adequate compaction of the aggregate base, subbase, and subgrade. Adequate compaction of fill materials, which are too coarse or too variable for density testing, should be evaluated by observation of the compaction method and proof-rolling with a loaded dump truck or other approved heavy construction vehicle.

5.7.3 Reclamation of Existing Materials

Reclamation of existing materials may be considered to reduce construction costs. It should be possible to re-use the existing aggregate base course or a mixture of aggregate base and reclaimed AC or CTB (ground to 1.5-inch minus particle size) as P-154 (Subbase Course) for reconstructed pavement sections. AC millings and reclaimed aggregate base may also be used as general site fill with less gradation restrictions outside of pavement areas. If in-place reclamation is used in pavement areas, it should follow the guidelines of Item P-207 as defined in FAA AC No.: 150/5370-10H.

5.7.4 Excavation of Cemented Soil

Hard, cemented soils (i.e., caliche) were encountered in explorations B-1, B-2, and B-7 at depths ranging from about 2.5 feet to 7.5 feet below existing grades. Previous explorations also encountered caliche at similar depths in different areas of the airport. The presence of such soil conditions should be considered when evaluating pavement excavations and trenching. PAE has significant experience from previous projects at PDT. Therefore, we

suggest referencing the previous construction projects to evaluate potential cost considerations for time, materials, and equipment.

6 DESIGN REVIEW AND CONSTRUCTION SERVICES

We welcome the opportunity to review and discuss construction plans and specifications for this project as they are being developed. In addition, GRI should be retained to review all geotechnical-related portions of the plans and specifications to evaluate whether they are in conformance with the recommendations provided in our report. To observe compliance with the intent of our recommendations, the design concepts, and the plans and specifications, we are of the opinion all construction operations pertaining to earthwork should be observed by a GRI representative. Our construction-phase services will allow for timely design changes if site conditions are encountered that are different from those described in our report. If we do not have the opportunity to confirm our interpretations, assumptions, and analyses during construction, we cannot be responsible for the application of our recommendations to subsurface conditions different from those described in this report.

7 LIMITATIONS

This report has been prepared for use by PAE. and should not be relied upon by any other entity without the written authorization of an authorized representative. The scope is limited to the specific project and location described within this report and our description of the project represents our understanding of the significant aspects of the project relevant to the evaluation, design, and construction of new or rehabilitated pavements. In the event that any changes in the design and location of the project elements as outlined in this report are planned, we should be given the opportunity to review the changes and modify or reaffirm the conclusions and recommendations of this report in writing.

The conclusions and recommendations submitted in this report are based on the data obtained from the explorations made at the locations indicated on Figure 2 and other sources of information discussed in this report. In the performance of subsurface investigations, specific information is obtained at specific locations at specific times. However, it is acknowledged that variations in soil conditions may exist between exploration locations. This report does not reflect any variations that may occur between these explorations. The nature and extent of variation may not become evident until construction. If, during construction, subsurface conditions differ from those encountered in the explorations, we should be advised at once so we can observe and review these conditions and reconsider our recommendations where necessary.

Please contact the undersigned if you have any questions.

Submitted for GRI,

Renews 06-2023

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This document has been submitted electronically.

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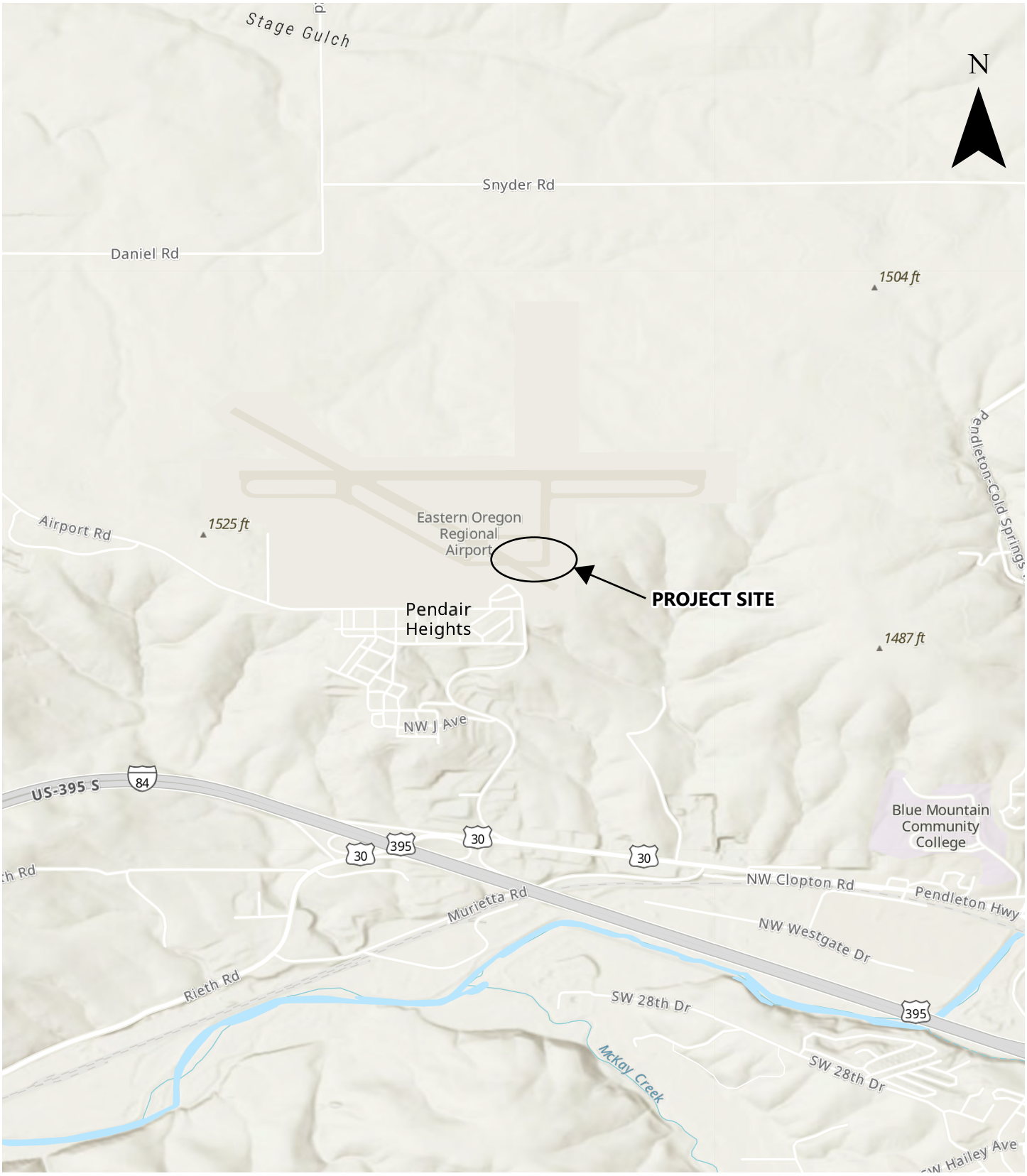


0 0.5 1 Miles

PRECISION APPROACH ENGINEERING, INC.
EASTERN OREGON REGIONAL AIRPORT
RUNWAY 29 RECONFIGURATION

VICINITY MAP

JAN. 2022 JOB NO. 6573-A FIG. 1

N

BORING COMPLETED BY GRI (NOV. 16, 2021)

0 150 300
Feet

GRI PRECISION APPROACH ENGINEERING, INC.
EASTERN OREGON REGIONAL AIRPORT
RUNWAY 29 RECONFIGURATION

SITE PLAN

JAN. 2022 JOB NO. 6573-A FIG. 2

APPENDIX A

Field Explorations and Laboratory Testing

APPENDIX A
FIELD EXPLORATIONS AND LABORATORY TESTING

A.1 FIELD EXPLORATIONS

A.1.1 General

Subsurface materials and conditions at the site were investigated on November 16, 2021, with eight drilled borings, designated B-1 through B-8. The approximate boring locations are shown on Figure 2. Borings B-1 through B-3 were completed in grass- or gravel-surfaced areas outside of the existing pavements and extended to depths ranging from about 3 feet to 11.5 feet below the ground surface. Practical drilling refusal was encountered in B-1 and B-2 at depths of about 11.3 feet and 3 feet, respectively. Borings B-4 through B-8 were completed in the existing pavement areas that include the runway and existing taxiways and apron. The pavement borings typically extended to a depth of about 5 feet below the paved surface, except B-7, which encountered practical drilling refusal at about 3.5 feet.

The exploration and field- and laboratory-testing programs completed for this project are described below.

A.1.2 Drilled Borings and Pavement Cores

The drilled borings were completed using a Buck Rogers 160 trailer-mounted drill rig with solid-stem auger drilling techniques, provided and operated by Dan J. Fischer Excavating, Inc., of Forest Grove, Oregon. Borings completed through the pavement (i.e., B-4 through B-8) were advanced using a 5-inch-diameter core drill through the AC (and CTB at B-5) prior to advancing the solid-stem auger. The AC and CTB cores were retained and photographed (Figures 10A through 12A.

Disturbed soil samples were obtained from the borings at various depths. In borings B-1 through B-3, samples were obtained at 2.5-foot intervals by driving a split-spoon in conjunction with the Standard Penetration Test (SPT). SPTs were conducted by driving the sampler into the soil a distance of 18 inches using a 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler the last 12 inches is known as the Standard Penetration Resistance, or SPT N-value. The SPT N-values provide a measure of relative density of granular soils and the relative consistency or stiffness of cohesive soils. Large grab samples were also obtained from B-1 and B-3 from a depth of about 0.5 feet to 2.5 feet. Grab samples of the aggregate base and subgrade were obtained from drill cuttings at selected depths from pavement borings B-4 through B-8.

An experienced representative of GRI's geology staff observed the explorations, coordinated the drilling and sampling depths, and maintained logs of the type, thickness, and condition of cores and the materials, and conditions encountered during the drilling operations. Logs of the borings are provided on Figures 1A through 8A. Table 1A includes a summary of pavement section thicknesses, including AC, CTB, and aggregate base, as measured in borings B-4 through B-8. A summary of pavement thickness and condition at the core locations is provided on Figure 9A. Photos of the pavement cores for B-4 through B-8 are provided on Figures 10A through 12A. The terms and symbols used to describe the materials encountered in the borings are defined in Table 4A and the attached legend.

Table 1A: SUMMARY OF PAVEMENT SECTION THICKNESSES

Location	AC Thickness, in.	CTB Thickness, in.	Aggregate Base Thickness, in.	Total Pavement Section Thickness, in.
B-4	14	-	11	25
B-5	6	5 ½	5½	17
B-6	10¾	-	11¾	22
B-7	4¾	-	6¼	11
B-8	14	-	4	18

Notes:

1. CTB was encountered beneath the AC in B-5 only with the current explorations. A previous exploration on Taxiway B, near the Runway 8-26 and Runway 11-29 intersection, also encountered CTB. CTB has not been encountered in other explorations at PDT.
2. Aggregate base encountered in the explorations typically consists of 1 or 1.5-inch minus crushed gravel with variable silt content.

A.1.3 Dynamic Cone Penetration Testing

DCP testing was completed in general accordance with ASTM International (ASTM) D6951 in pavement borings B-4 through B-8 using a Kessler model DCP manufactured by KSE Testing Equipment. The DCP test consists of driving a ⅝-inch-diameter steel rod with a cone tip into the soil using a 17.6-pound sliding hammer dropped from a fixed height of 22.6 inches. The penetration versus hammer drop, or blow count (mm/blow), is recorded as the DCP value. ODOT and FAA provide correlations for estimating the in-situ resilient modulus from the DCP test results, which can also be correlated with CBR values for the subgrade based on recommendations in FAA AC No.: 150/5320-6G. Logs of the DCP penetration versus depth are provided on Figures 13A through 18A. A summary of the test results, including correlated moduli and CBR value, are provided in Table 2A. Where DCP testing encountered variable subgrade stiffness with depth, we used Odemark's method of equivalent thickness (MET) to calculate a single, representative subgrade resilient modulus value.

Table 2A: DCP SUMMARY TABLE

DCP Test Location	Aggregate Base Modulus, psi	Subgrade Modulus, psi	Correlated Subgrade CBR
B-4	24,150	8,530	5.7
B-5	19,870	5,860	3.9
B-6	29,810	6,690	4.5
B-7	16,680	8,230	5.5
B-8	26,200	6,290	4.2
Average	23,340	7,120	4.8
Standard Deviation (SD)	5,170	1,190	0.8
Coefficient of Variation	22.2%	16.7%	16.7%
Average – 1 SD	**18,170**	**5,930**	**4.0**

A.2 LABORATORY TESTING

A.2.1 General

The samples obtained from the borings were examined in our laboratory, where the physical characteristics of the samples were noted and the field classifications modified where necessary. At the time of classification, the natural moisture content of selected samples was determined, as indicated on the logs. Additional testing in GRI's lab included washed sieve grain-size analyses.

Laboratory testing was also completed by FEI Testing & Inspection, Inc. (FEI T&I), of Corvallis, Oregon. A member of GRI's engineering staff selected the samples and delivered them to the office of FEI T&I. The testing included natural moisture content determinations, moisture-density relationships, CBR tests, Atterberg limits determinations, and grain-size analyses.

A summary of most of the laboratory test results has been provided in Table 5A. The following sections describe the testing program in more detail.

A.2.2 Natural Moisture Content

Natural moisture content determinations were made in conformance with ASTM International (ASTM) D2216. The results are summarized on Figures 1A through 8A and in Table 5A.

A.2.3 Grain-Size Analysis

A.2.3.1 Washed-Sieve Method

To assist in the classification of the soils, samples of known dry weight were washed over a No. 200 sieve. The material retained on the sieve was oven dried and weighed. The

percentage of material passing the No. 200 sieve was then calculated. The results are summarized on Figures 1A through 8A, where applicable, and in Table 5A.

A.2.3.2Mechanical-Sieve with Hydrometer

Mechanical-sieve and hydrometer analyses were completed by FEI T&I on a selected sample obtained from a mixture of bulk subgrade samples combined from B-1 and B-3. The testing was done in substantial conformance with ASTM C136/C117 and ASTM D422. The test is performed by taking a sample of known dry weight and washing it over a No. 200 sieve. The soil retained on the No. 200 sieve is then screened through a series of sieves of various sizes using a sieve shaker. The weight of each sieve is measured prior to and after the test. The weight of the sample retained on each sieve is recorded and expressed as a percentage of the total sample weight. The material retained on the sieve is oven-dried and weighed, and the percentage of material passing the No. 200 sieve is calculated. The distribution of particle sizes smaller than the No. 200 sieve (i.e., 0.075 mm), to about 0.001 mm, is then determined by a sedimentation process using a hydrometer. The test results are shown on Figure 19A.

A.2.4 Atterberg Limits

Atterberg-limits determinations were completed by FEI T&I on a selected sample obtained from a mixture of bulk subgrade samples combined from B-1 and B-3. The testing was done in substantial conformance with ASTM D4318. The results of the tests are shown graphically Figure 20A and in Table 5A.

A.2.5 Moisture-Density

Laboratory testing to evaluate the compaction characteristics of a selected soil sample was completed by FEI T&I in conformance with ASTM D1557. The test is used to estimate the relationship between moisture content and the relative maximum dry unit weight of the soil (i.e., compaction curve). For the modified effort test, the soil is compacted in a 4- or 6-inch diameter mold with a 10-pound ram dropped from a height of about 18 inches, producing a compactive effort of about 56,000 foot-pounds per cubic foot (ft-lb/ft^3). The test results are shown graphically in Figure 21A.

A.2.6 California Bearing Ratio

A CBR test was completed by FEI T&I in conformance with ASTM D1883. The test is used to determine the CBR value of a soil specimen at a specific moisture content and selected range of compactive effort or soil unit weight. The sample is compacted within the CBR mold, soaked, then penetrated a depth of about 0.5 inch. The CBR value corresponds to the soil resistance at a selected penetration depth (typically 0.1 inch or 0.2 inch) compared to the *standard unit stress* indicated by the test method for a crushed stone equivalent.

The CBR test completed as part of this investigation used the results from the moisture-density test described above, with the sample compacted near the optimum moisture content and to a dry unit weight within the range of approximately 90% to 100% of the relative maximum dry unit weight. The CBR value was reported based on the results for soil compacted to about 95% of the maximum dry unit weight. The results of the tests are shown graphically in Figure 22A.

A.2.7 Summary and Comparison with Previous Moisture-Density and CBR Test Results

Moisture-density and CBR tests have been completed by others as part of previous investigations for PAE at Eastern Oregon Regional Airport. A summary of the current and previous test results is provided in Table 3A. Table 3A also includes a summary of liquid limits (LL) and plasticity index (PI) results from Atterberg limits tests and percent passing the No. 200 sieve (P200), where applicable, as well as the USCS classification for the tested samples. The results indicate the current moisture-density and CBR tests are comparable to previous test results for similar soils classified as ML.

Table 3A: SUMMARY OF MOISTURE-DENSITY AND CBR TEST RESULTS
CURRENT AND PREVIOUS EASTERN OREGON REGIONAL AIRPORT PROJECTS

Project	Maximum Dry Density, pcf	Optimum Moisture Content, %	LL	PI	P200, %	USCS	CBR Value
Runway 29 Reconfiguration (2022)	112.4	14.9	28	5	85	ML	34.6
Taxilanes and Apron Rehabilitation (2021)	110.8	14.8			86	ML	29.2
UAS Facility (2021)	102.2	19.4		NP	77	ML	23.3
Runway 8-26 Rehabilitation (2017)	109.7	16.0		NP	87	ML	18.3
	106.2	16.7		NP	91	ML	15.4

Notes:

1. The maximum dry density and optimum moisture content are based on the results of ASTM D1557.
2. The CBR values are based on samples compacted to 95% relative compaction based on the results of the moisture-density tests.
3. NP indicates the test samples are non-plastic.

Table 4A
GUIDELINES FOR CLASSIFICATION OF SOIL

Description of Relative Density for Granular Soil

Relative Density	Standard Penetration Resistance (N-values), blows/feet
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	over 50

Description of Consistency for Fine-Grained (Cohesive) Soils

Consistency	Standard Penetration Resistance (N-values), blows/feet	Torvane or Undrained Shear Strength, tsf
Very Soft	0 - 2	less than 0.125
Soft	2 - 4	0.125 - 0.25
Medium Stiff	4 - 8	0.25 - 0.50
Stiff	8 - 15	0.50 - 1.0
Very Stiff	15 - 30	1.0 - 2.0
Hard	over 30	over 2.0

Grain-Size Classification	Modifier for Subclassification		
		Primary Constituent SAND or GRAVEL	Primary Constituent SILT or CLAY
	Adjective	Percentage of Other Material (By Weight)	
Boulders: >12 inches *Cobbles:* 3-12 inches *Gravel:* ¼ - ¾ inch (fine); ¾ - 3 inches (coarse) *Sand:* No. 200 - No. 40 sieve (fine); No. 40 - No. 10 sieve (medium); No. 10 - No. 4 sieve (coarse) *Silt/Clay:* Pass No. 200 sieve	trace:	5 - 15 (sand, gravel)	5 - 15 (sand, gravel)
	some:	15 - 30 (sand, gravel)	15 - 30 (sand, gravel)
	sandy, gravelly:	30 - 50 (sand, gravel)	30 - 50 (sand, gravel)
	trace:	<5 (silt, clay)	*Relationship of clay and silt determined by plasticity index test*
	some:	5 - 12 (silt, clay)	
	silty, clayey:	12 - 50 (silt, clay)	

Table 5A

SUMMARY OF LABORATORY RESULTS

Sample Information						Atterberg Limits			
Location	Sample	Depth, ft	Elevation, ft	Moisture Content, %	Dry Unit Weight, pcf	Liquid Limit, %	Plasticity Index, %	Fines Content, %	Soil Type
B-1	S-1	2.5	--	16	--	--	--	85	SILT
	S-3	7.5	--	21	--	--	--	76	SILT
B-2	S-1	2.5	--	13	--	--	--	--	SILT
B-3	S-1	2.5	--	16	--	--	--	66	FILL
B-4	S-2	2.5	--	20	--	--	--	--	SILT
	S-3	3.0	--	25	--	--	--	88	SILT
B-5	S-2	2.0	--	23	--	--	--	87	SILT
	S-4	4.0	--	23	--	--	--	--	SILT
B-6	S-1	1.0	--	10	--	--	--	--	GRAVEL
	S-2	2.5	--	22	--	--	--	80	SILT
B-7	S-2	1.5	--	28	--	--	--	--	Sandy SILT
	S-3	2.0	--	29	--	--	--	68	Sandy SILT
	S-4	3.0	--	16	--	--	--	--	Sandy SILT
B-8	S-2	1.5	--	17	--	--	--	--	SILT

BORING AND TEST PIT LOG LEGEND

SOIL SYMBOLS

Symbol	Typical Description
	LANDSCAPE MATERIALS
	FILL
	GRAVEL; clean to some silt, clay, and sand
	Sandy GRAVEL; clean to some silt and clay
	Silty GRAVEL; up to some clay and sand
	Clayey GRAVEL; up to some silt and sand
	SAND; clean to some silt, clay, and gravel
	Gravelly SAND; clean to some silt and clay
	Silty SAND; up to some clay and gravel
	Clayey SAND; up to some silt and gravel
	SILT; up to some clay, sand, and gravel
	Gravelly SILT; up to some clay and sand
	Sandy SILT; up to some clay and gravel
	Clayey SILT; up to some sand and gravel
	CLAY; up to some silt, sand, and gravel
	Gravelly CLAY; up to some silt and sand
	Sandy CLAY; up to some silt and gravel
	Silty CLAY; up to some sand and gravel
	PEAT

BEDROCK SYMBOLS

Symbol	Typical Description
	BASALT
	MUDSTONE
	SILTSTONE
	SANDSTONE

SURFACE MATERIAL SYMBOLS

Symbol	Typical Description
	Asphalt concrete PAVEMENT
	Portland cement concrete PAVEMENT
	Crushed rock BASE COURSE

SAMPLER SYMBOLS

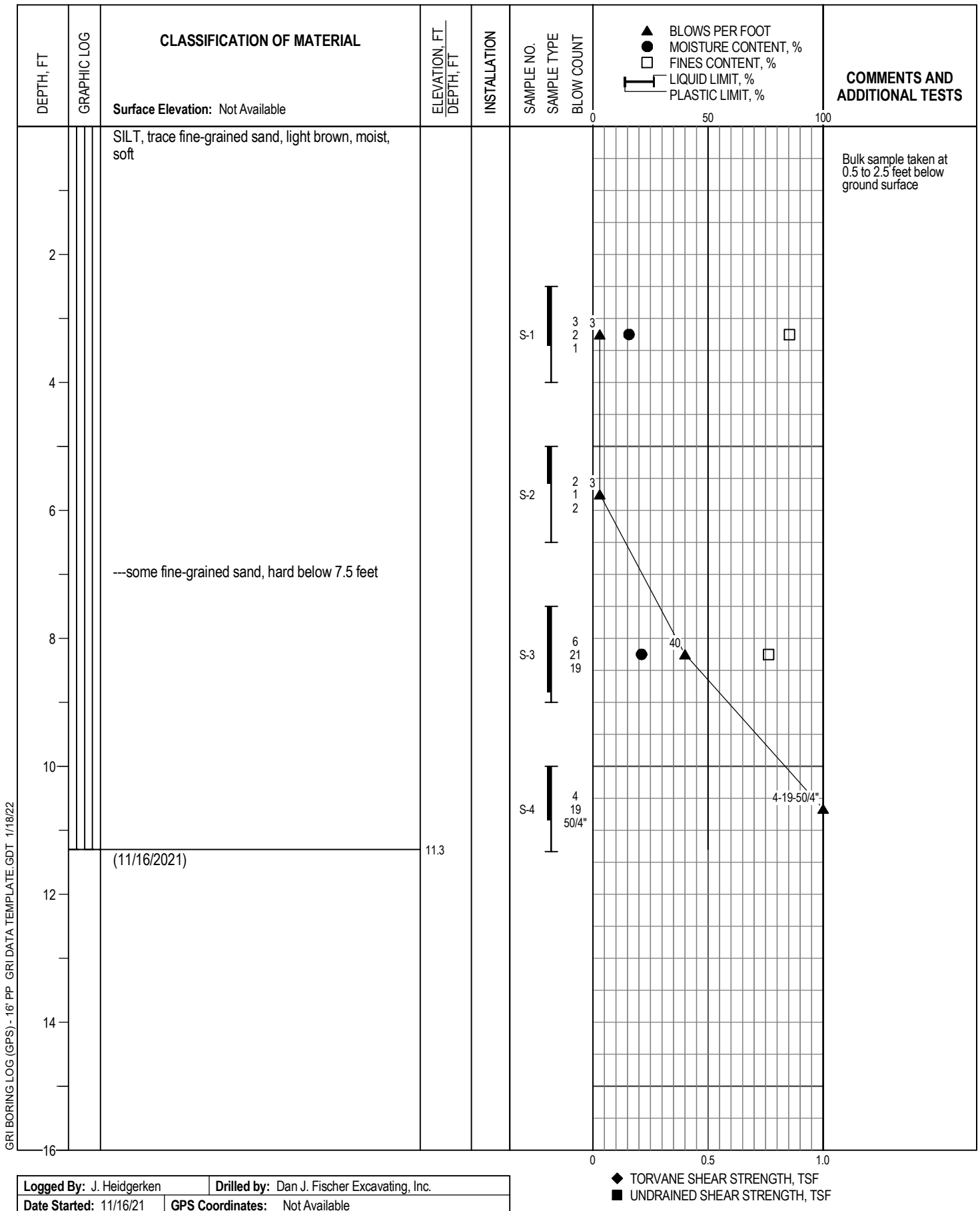
Symbol	Sampler Description
	2.0 in. O.D. split-spoon sampler and Standard Penetration Test with recovery (ASTM D1586)
	Shelby tube sampler with recovery (ASTM D1587)
	3.0 in. O.D. split-spoon sampler with recovery (ASTM D3550)
	Grab Sample
	Rock core sample interval
	Sonic core sample interval
	Push probe sample interval

INSTALLATION SYMBOLS

Symbol	Symbol Description
	Flush-mount monument set in concrete
	Concrete, well casing shown where applicable
	Bentonite seal, well casing shown if applicable
	Filter pack, machine-slotted well casing shown where applicable
	Grout, vibrating-wire transducer cable shown where applicable
	Vibrating-wire pressure transducer
	1-in.-diameter solid PVC
	1-in.-diameter hand-slotted PVC
	Grout, inclinometer casing shown where applicable

FIELD MEASUREMENTS

Symbol	Typical Description
	Groundwater level during drilling and date measured
	Groundwater level after drilling and date measured
	Rock/sonic core or push probe recovery (%)
	Rock quality designation (RQD, %)

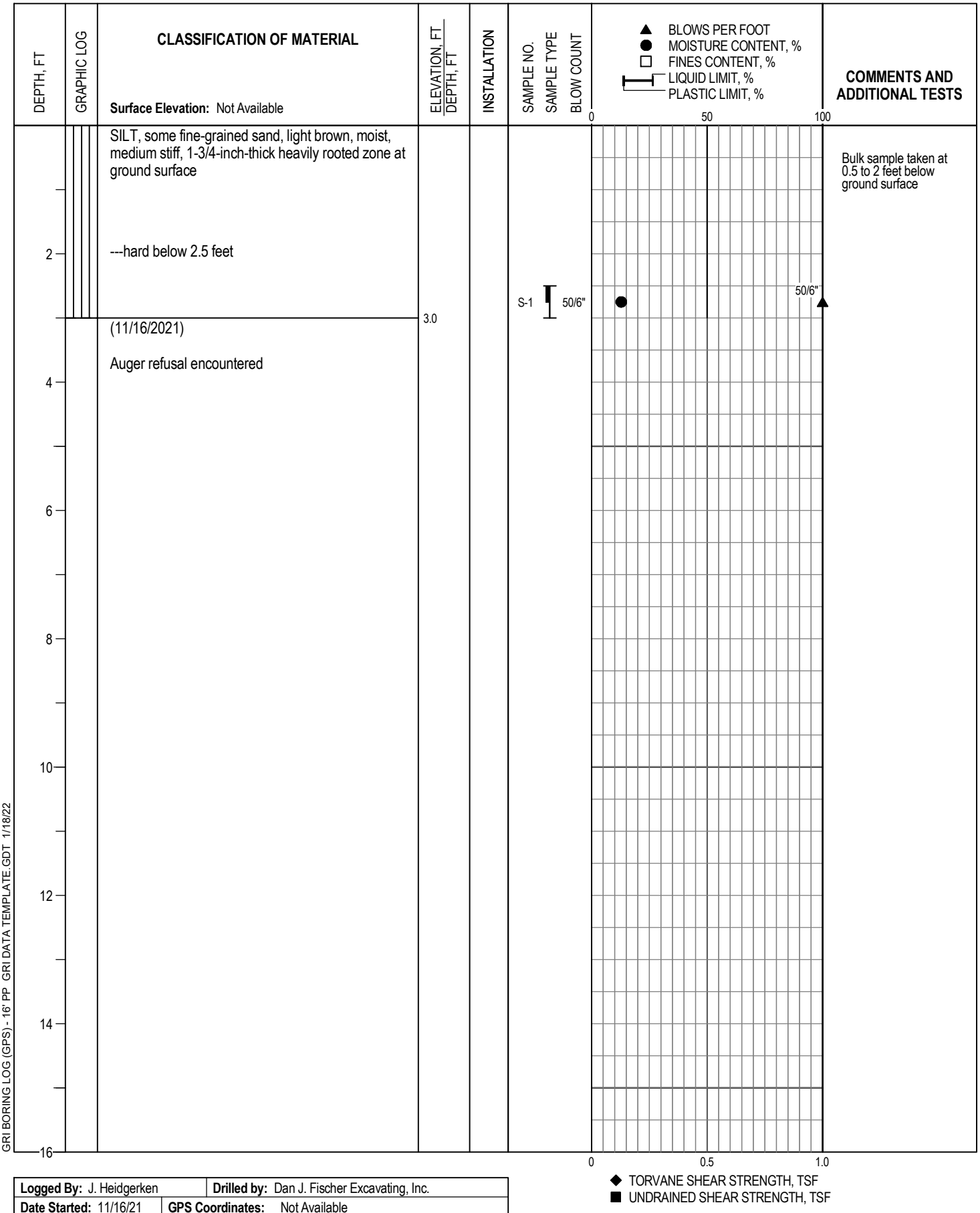


GRI BORING LOG (GPS) - 16' PP GRI DATA TEMPLATE.GDT 1/18/22

Logged By: J. Heidgerken	**Drilled by:** Dan J. Fischer Excavating, Inc.
Date Started: 11/16/21	**GPS Coordinates:** Not Available
Drilling Method: Solid-Stem Auger **Equipment:** Buck Rogers 160 Trailer-Mounted Rig **Hole Diameter:**	**Hammer Type:** Cat Head **Weight:** 140 lb **Drop:** 30 in. **Energy Ratio:** Not Available
Note: See Legend for Explanation of Symbols	

BORING B-1

JAN. 2022 JOB NO. 6573-A FIG. 1A



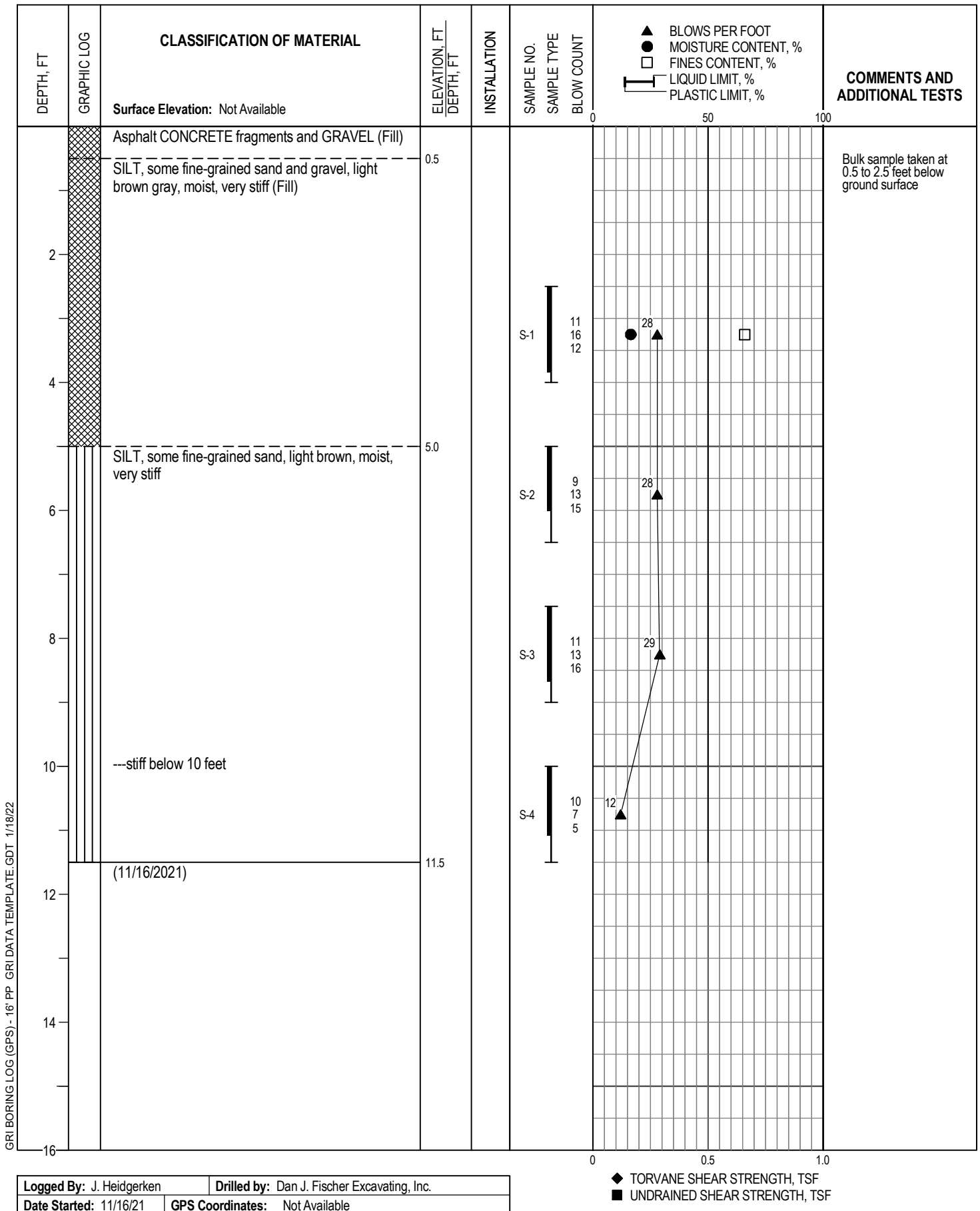
GRI BORING LOG (GPS) - 16' PP GRI DATA TEMPLATE.GDT 1/18/22

Logged By: J. Heidgerken		**Drilled by:** Dan J. Fischer Excavating, Inc.	
Date Started: 11/16/21	**GPS Coordinates:** Not Available		
Drilling Method: Solid-Stem Auger **Equipment:** Buck Rogers 160 Trailer-Mounted Rig **Hole Diameter:**		**Hammer Type:** Cat Head **Weight:** 140 lb **Drop:** 30 in.	
Note: See Legend for Explanation of Symbols		**Energy Ratio:** Not Available	

GRI

BORING B-2

JAN. 2022 JOB NO. 6573-A FIG. 2A



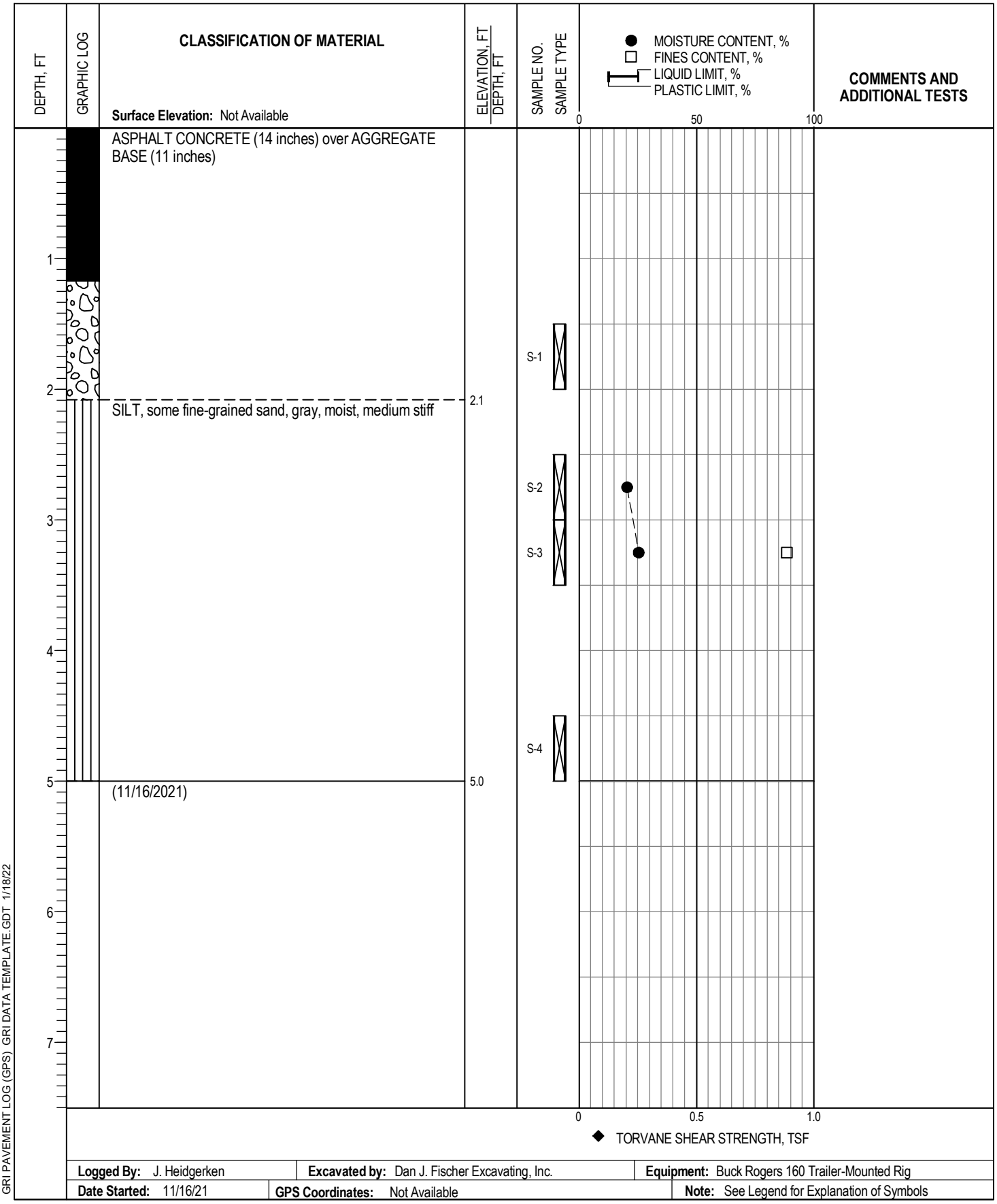
GRI BORING LOG (GPS) - 16' PP GRI DATA TEMPLATE.GDT 1/18/22

Logged By: J. Heidgerken	**Drilled by:** Dan J. Fischer Excavating, Inc.		
Date Started: 11/16/21	**GPS Coordinates:** Not Available		
Drilling Method: Solid-Stem Auger **Equipment:** Buck Rogers 160 Trailer-Mounted Rig **Hole Diameter:**		**Hammer Type:** Cat Head **Weight:** 140 lb **Drop:** 30 in.	
Note: See Legend for Explanation of Symbols		**Energy Ratio:** Not Available	

GRI

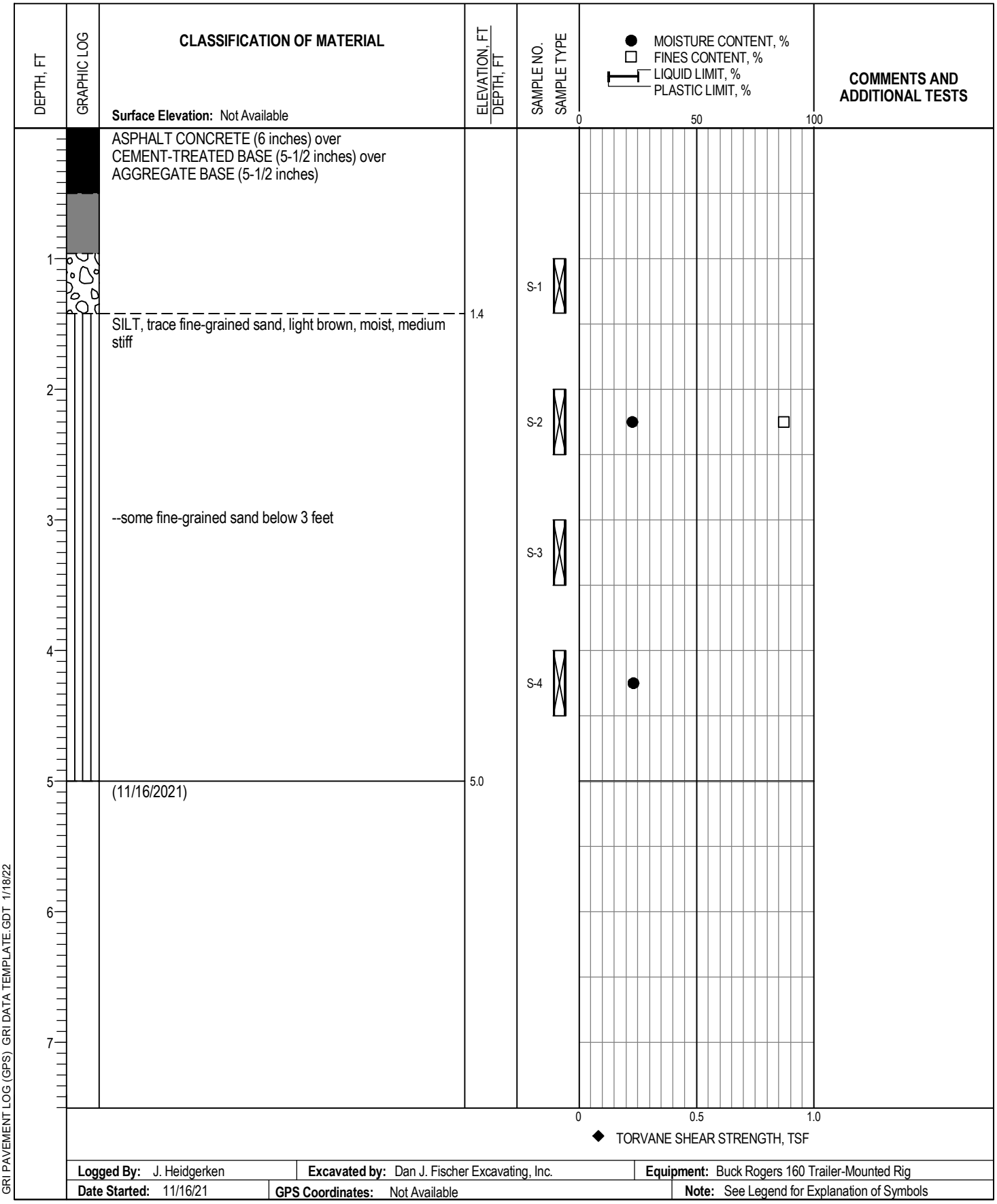
BORING B-3

JAN. 2022 JOB NO. 6573-A FIG. 3A



BORING B-4

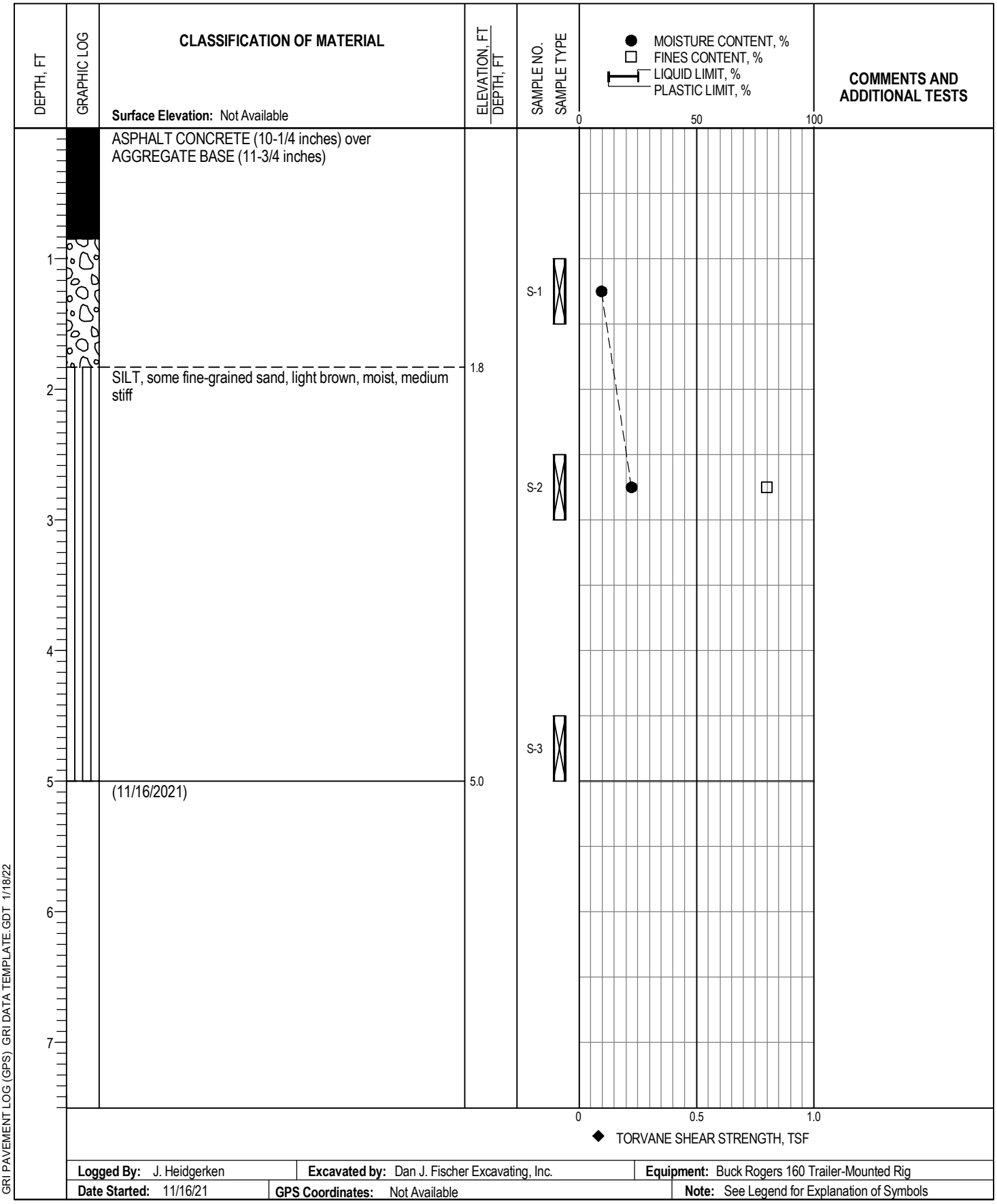
JAN. 2022 JOB NO. 6573-A FIG. 4A



GRI PAVEMENT LOG (GPS) GRI DATA TEMPLATE.GDT 1/18/22

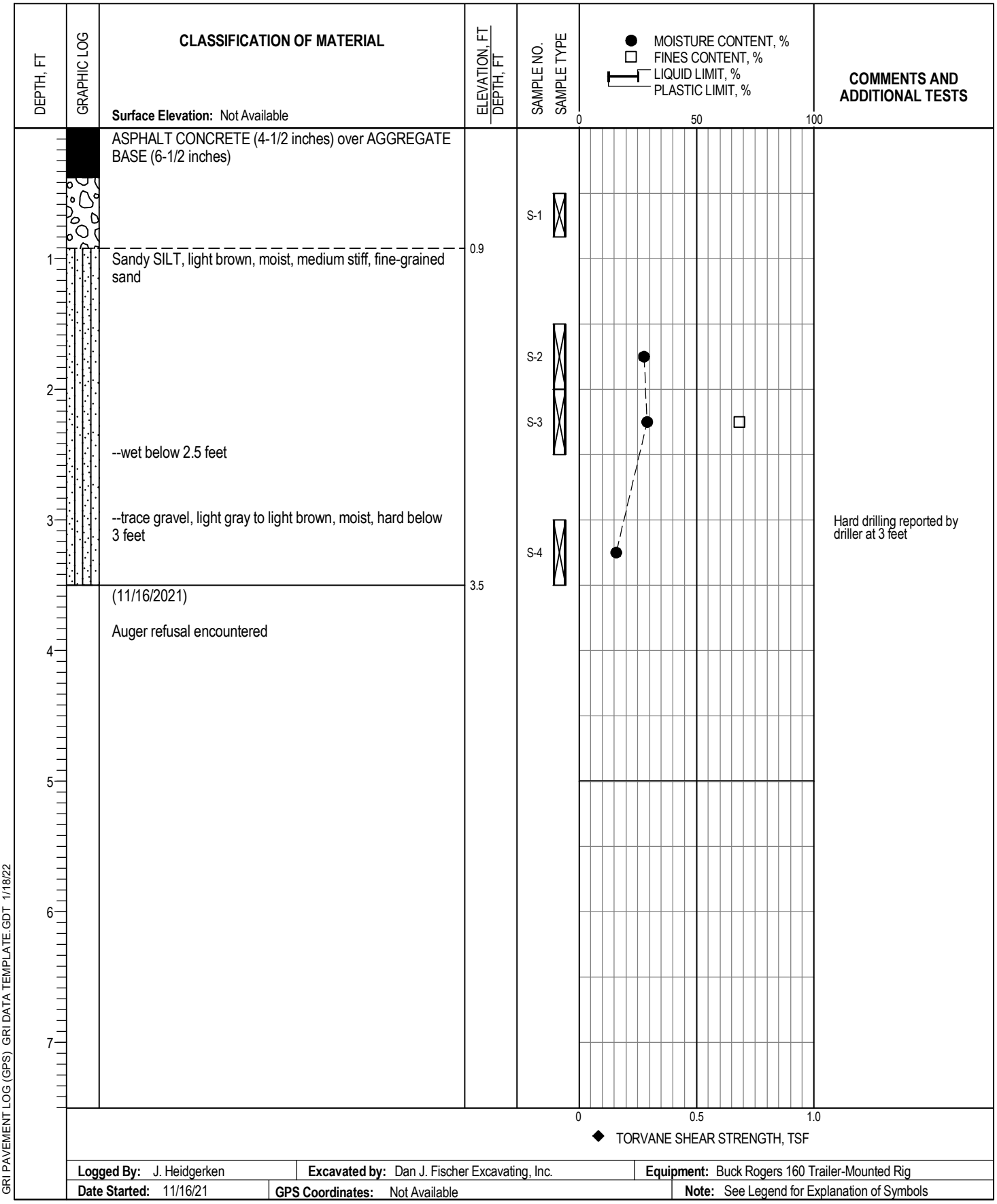
BORING B-5

JAN. 2022 JOB NO. 6573-A FIG. 5A



BORING B-6

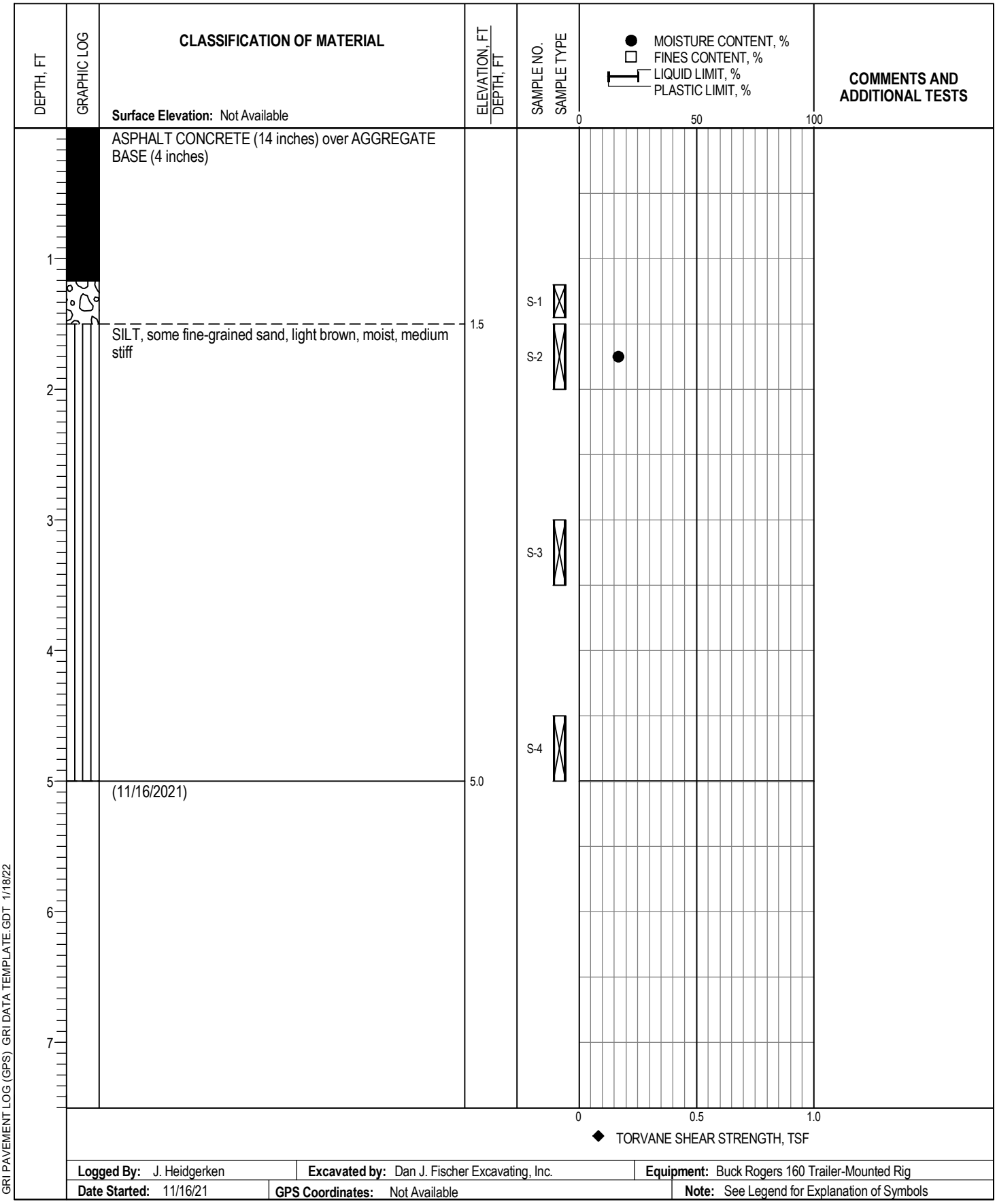
JAN. 2022 JOB NO. 6573-A FIG. 6A



GRI PAVEMENT LOG (GPS) GRI DATA TEMPLATE.GDT 1/18/22

BORING B-7

JAN. 2022 JOB NO. 6573-A FIG. 7A



GRI PAVEMENT LOG (GPS) GRI DATA TEMPLATE.GDT 1/18/22

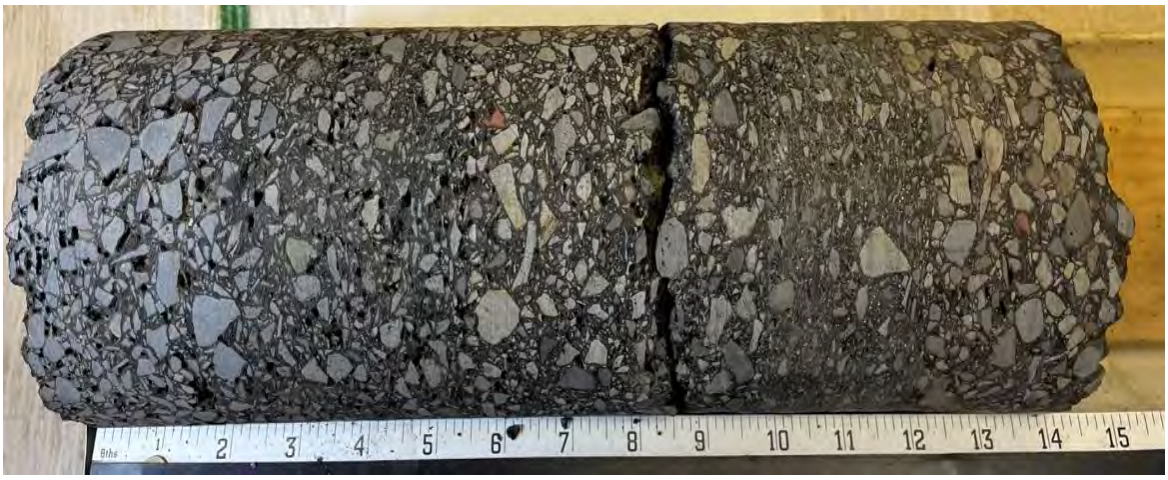
BORING B-8

JAN. 2022 JOB NO. 6573-A FIG. 8A

PRECISION APPROACH ENGINEERING, INC.
EASTER OREGON REGIONAL AIRPORT
RUNWAY 29 RECONFIGURATION

PAVEMENT CORE SUMMARY

JAN. 2022 JOB NO. 6573-A FIG. 9A



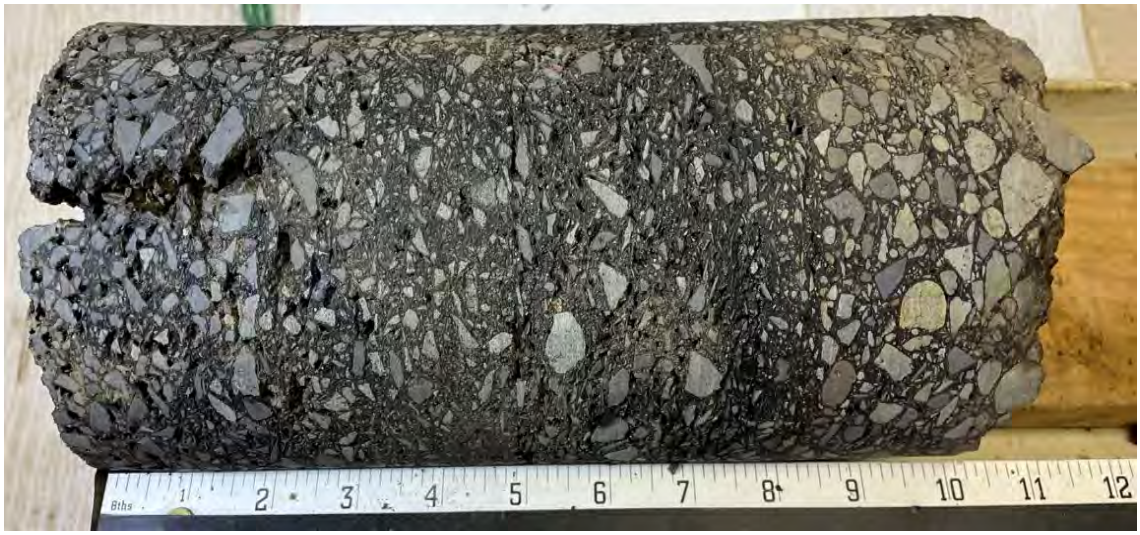
Core B-4 Sample

Core B-5 Sample

PRECISION APPROACH ENGINEERING, INC.
EASTERN OREGON REGIONAL AIRPORT
RUNWAY 29 RECONFIGURATION

PAVEMENT CORE PHOTOGRAPHS

JAN. 2022 JOB NO. 6573-A FIG. 10A



Core B-6 Sample

Core B-7 Sample

PRECISION APPROACH ENGINEERING, INC.
EASTERN OREGON REGIONAL AIRPORT
RUNWAY 29 RECONFIGURATION

PAVEMENT CORE PHOTOGRAPHS

JAN. 2022 JOB NO. 6573-A FIG. 11A

Core B-8 Sample

GRI

PRECISION APPROACH ENGINEERING, INC.
EASTERN OREGON REGIONAL AIRPORT
RUNWAY 29 RECONFIGURATION

PAVEMENT CORE PHOTOGRAPHS

JAN. 2022 JOB NO. 6573-A FIG. 12A

KESSLER DYNAMIC CONE PENETROMETER LOG

JOB NO.:	6573-A	DRAWN BY: JGH	TESTING DATE:	11/16/2021

Test Number	B-4	Surface Type	Below AC -14.0 inches
Location	Eastern Oregon Regional Airport at Pendleton	Hammer	17.6 pounds

Depth, inches	Depth, millimeters	Cumulative Blows	Slope
0.0	0	0	---
0.3	8	1	0.13
0.9	22	6	0.36
1.3	33	11	0.45
1.7	42	16	0.56
2.0	50	21	0.63
2.2	57	26	0.71
3.0	75	36	0.56
3.7	95	46	0.50
4.5	114	56	0.53
5.2	132	66	0.56
5.7	145	76	0.77
6.4	163	86	0.56
7.2	183	96	0.50
8.2	209	106	0.38
8.8	223	116	0.71
9.3	235	126	0.83
9.9	251	136	0.63
10.6	269	146	0.56
11.9	301	156	0.31
12.9	327	161	0.19
14.2	360	166	0.15
15.6	395	171	0.14
17.0	433	176	0.13
18.7	474	181	0.12
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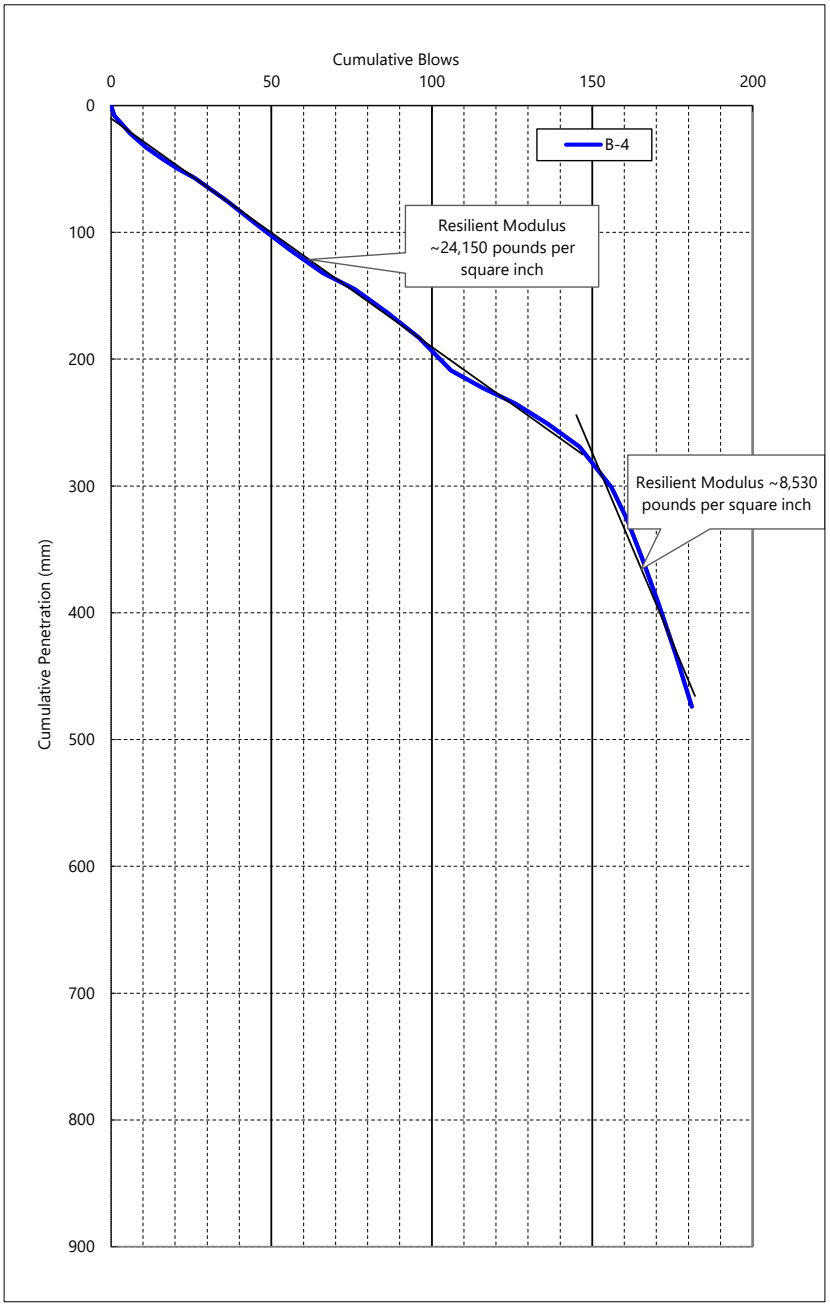

GRI

DYNAMIC CONE PENETROMETER

JAN. 2022 JOB NO. 6573-A FIG. 13A

KESSLER DYNAMIC CONE PENETROMETER LOG

JOB NO.: 6573-A | DRAWN BY: JGH | TESTING DATE: 11/16/2021

Test Number	B-5	Surface Type	Below AC & CTB -11.5 inches
Location	Eastern Oregon Regional Airport at Pendleton	Hammer	17.6 pounds

Depth, inches	Depth, millimeters	Cumulative Blows	Slope
0.0	0	0	---
0.8	21	5	0.24
1.4	35	10	0.36
1.8	45	15	0.50
2.6	67	25	0.45
4.4	112	35	0.22
5.3	134	38	0.14
6.2	158	41	0.13
7.4	189	44	0.10
9.1	230	47	0.07
10.8	274	50	0.07
12.7	322	53	0.06
14.8	377	56	0.05
17.3	439	59	0.05
19.8	504	62	0.05
21.6	549	64	0.04
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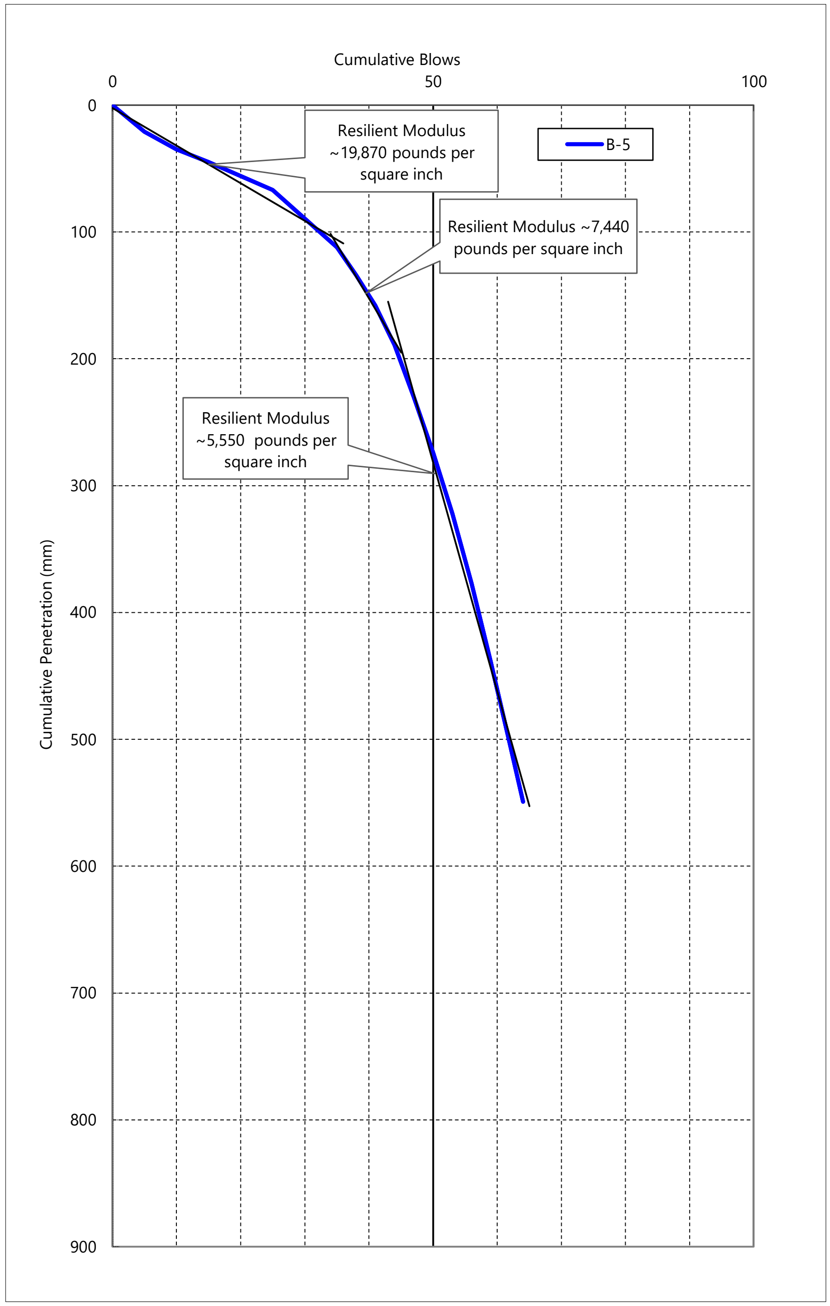

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KESSLER DYNAMIC CONE PENETROMETER LOG

JOB NO.: 6573-A	DRAWN BY: JGH	TESTING DATE: 11/16/2021

Test Number	B-6	Surface Type	Below AC -10.25 inches
Location	Eastern Oregon Regional Airport at Pendleton	Hammer	17.6 pounds

Depth, inches	Depth, millimeters	Cumulative Blows	Slope
0.0	0	0	---
0.4	11	1	0.09
1.0	25	11	0.71
1.5	38	21	0.77
1.7	42	31	2.50
1.8	46	41	2.50
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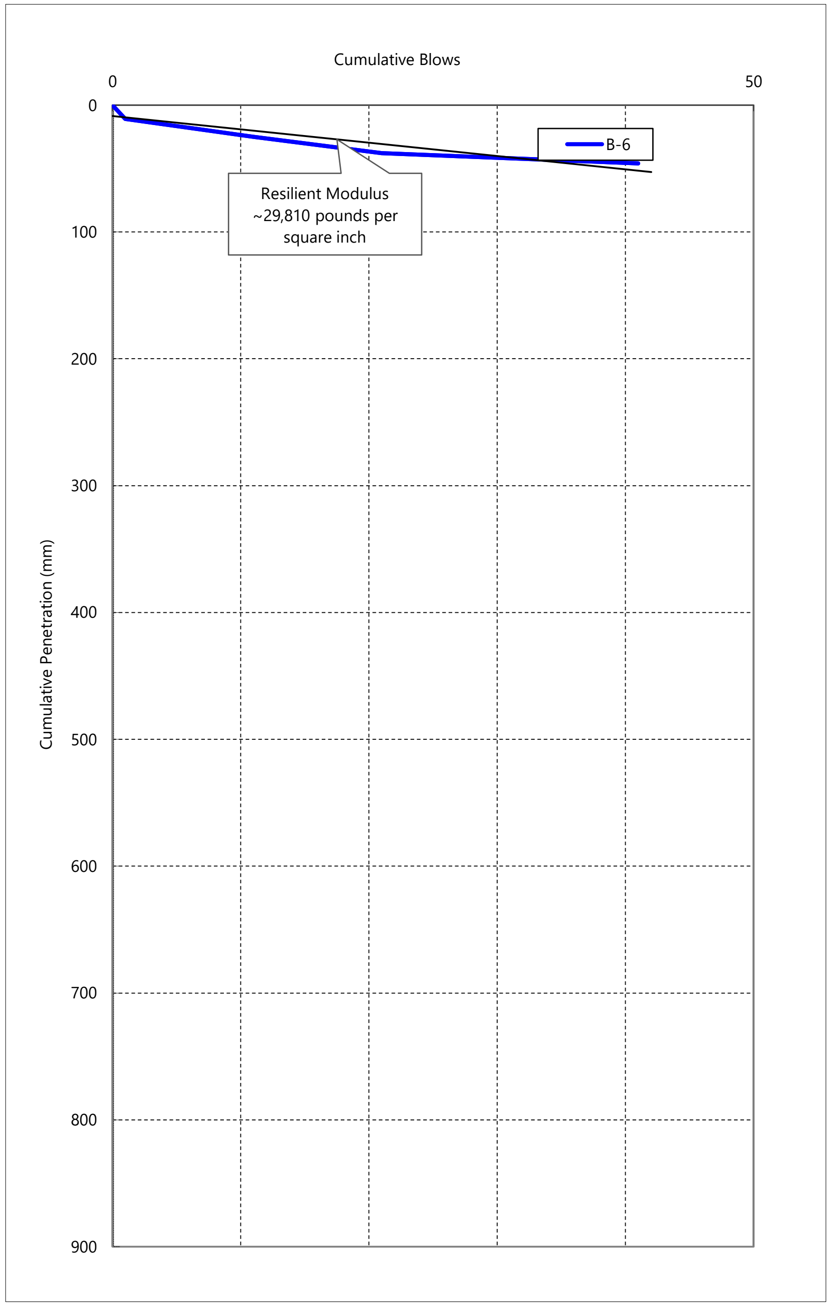

GRI

DYNAMIC CONE PENETROMETER

JAN. 2022 JOB NO. 6573-A FIG. 15A

KESSLER DYNAMIC CONE PENETROMETER LOG

JOB NO.: 6573-A	DRAWN BY: JGH	TESTING DATE: 11/16/2021

Test Number	B-6	Surface Type	Below Base -22.0 inches
Location	Eastern Oregon Regional Airport at Pendleton	Hammer	17.6 pounds

Depth, inches	Depth, millimeters	Cumulative Blows	Slope
0.0	0	0	---
0.8	21	1	0.05
1.7	44	3	0.09
2.6	66	5	0.09
3.5	89	7	0.09
4.4	112	9	0.09
5.4	137	11	0.08
6.3	160	13	0.09
7.1	181	15	0.10
8.0	203	17	0.09
8.9	225	19	0.09
9.6	245	21	0.10
10.5	266	23	0.10
11.3	286	25	0.10
12.0	305	27	0.11
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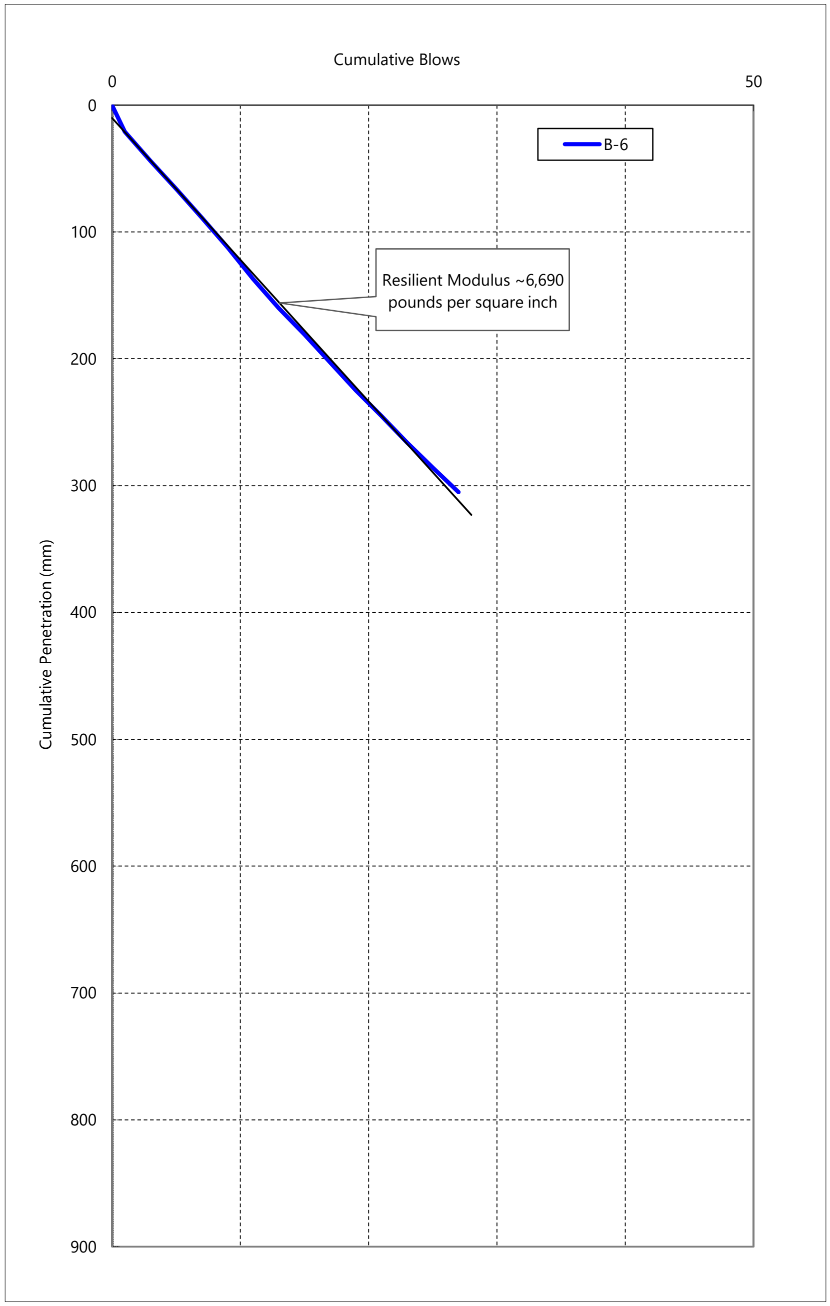

GRI

DYNAMIC CONE PENETROMETER

JAN. 2022 JOB NO. 6573-A FIG. 16A

KESSLER DYNAMIC CONE PENETROMETER LOG

JOB NO.:	6573-A	DRAWN BY: JGH	TESTING DATE:	11/16/2021

Test Number	B-7	Surface Type	Below AC -4.75 inches
Location	Eastern Oregon Regional Airport at Pendleton	Hammer	17.6 pounds

Depth, inches	Depth, millimeters	Cumulative Blows	Slope
0.0	0	0	---
1.0	26	5	0.19
1.9	49	10	0.22
3.0	75	15	0.19
4.1	103	20	0.18
4.8	122	25	0.26
5.6	142	30	0.25
6.3	161	35	0.26
7.2	183	40	0.23
8.0	202	43	0.16
9.1	230	46	0.11
10.9	277	49	0.06
12.5	317	51	0.05
13.5	343	56	0.19
14.1	357	61	0.36
14.6	370	66	0.38
15.1	383	71	0.38
15.7	398	76	0.33
16.4	416	81	0.28
17.3	439	86	0.22
18.5	469	91	0.17
19.9	505	96	0.14
21.1	535	101	0.17
22.8	578	106	0.12
24.2	615	111	0.14
25.7	654	113	0.05
27.0	686	114	0.03
27.7	704	115	0.06
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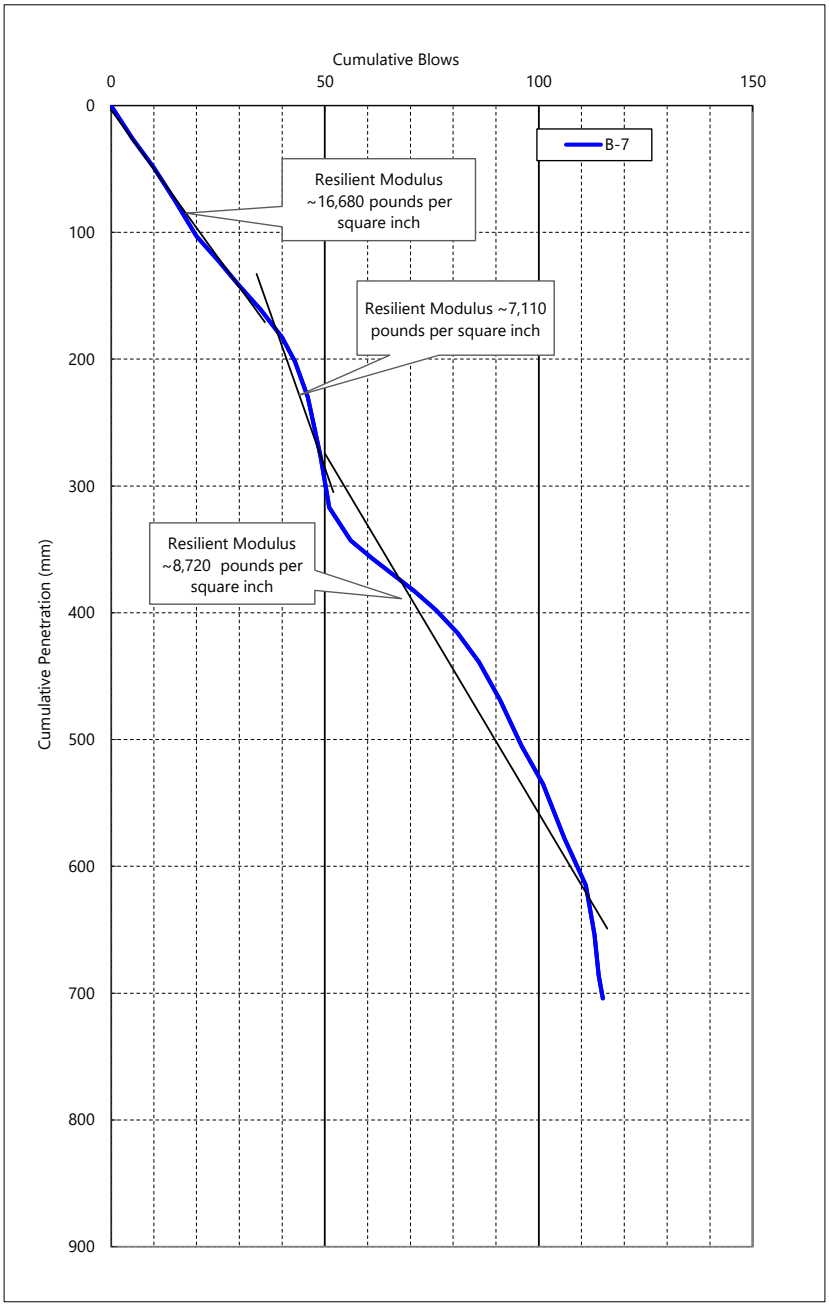

GRI

DYNAMIC CONE PENETROMETER

JAN. 2022 JOB NO. 6573-A FIG. 17A

KESSLER DYNAMIC CONE PENETROMETER LOG

JOB NO.: 6573-A DRAWN BY: JGH TESTING DATE: 11/16/2021

Test Number	B-8	Surface Type	Below AC -14.0 inches
Location	Eastern Oregon Regional Airport at Pendleton	Hammer	17.6 pounds

Depth, inches	Depth, millimeters	Cumulative Blows	Slope
0.0	0	0	---
1.0	26	5	0.19
1.5	38	15	0.83
1.8	46	25	1.25
2.2	56	35	1.00
2.5	64	45	1.25
3.2	81	55	0.59
3.8	96	60	0.33
4.6	118	65	0.23
5.8	148	70	0.17
7.2	182	75	0.15
8.7	221	80	0.13
10.8	274	85	0.09
12.5	317	88	0.07
14.4	367	91	0.06
16.7	423	94	0.05
19.4	493	97	0.04
20.3	516	98	0.04
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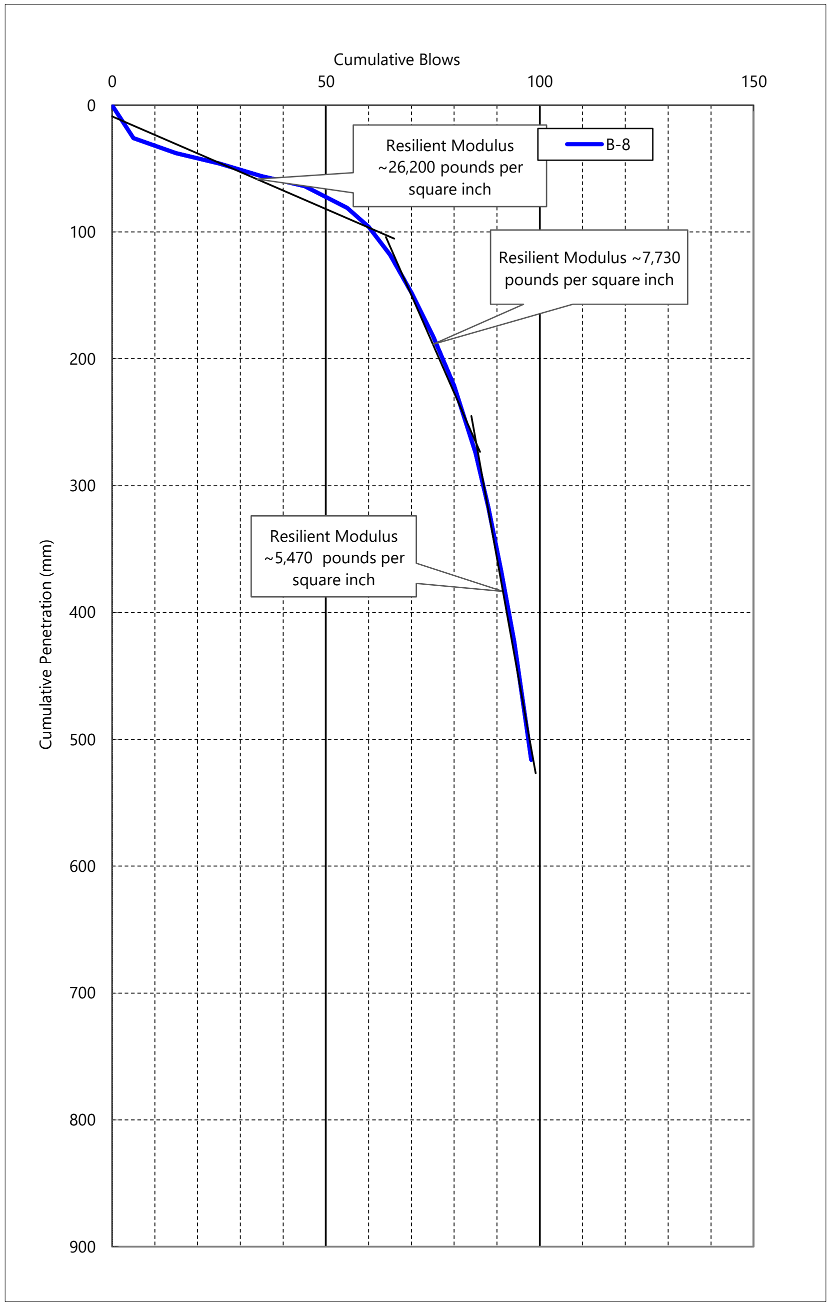
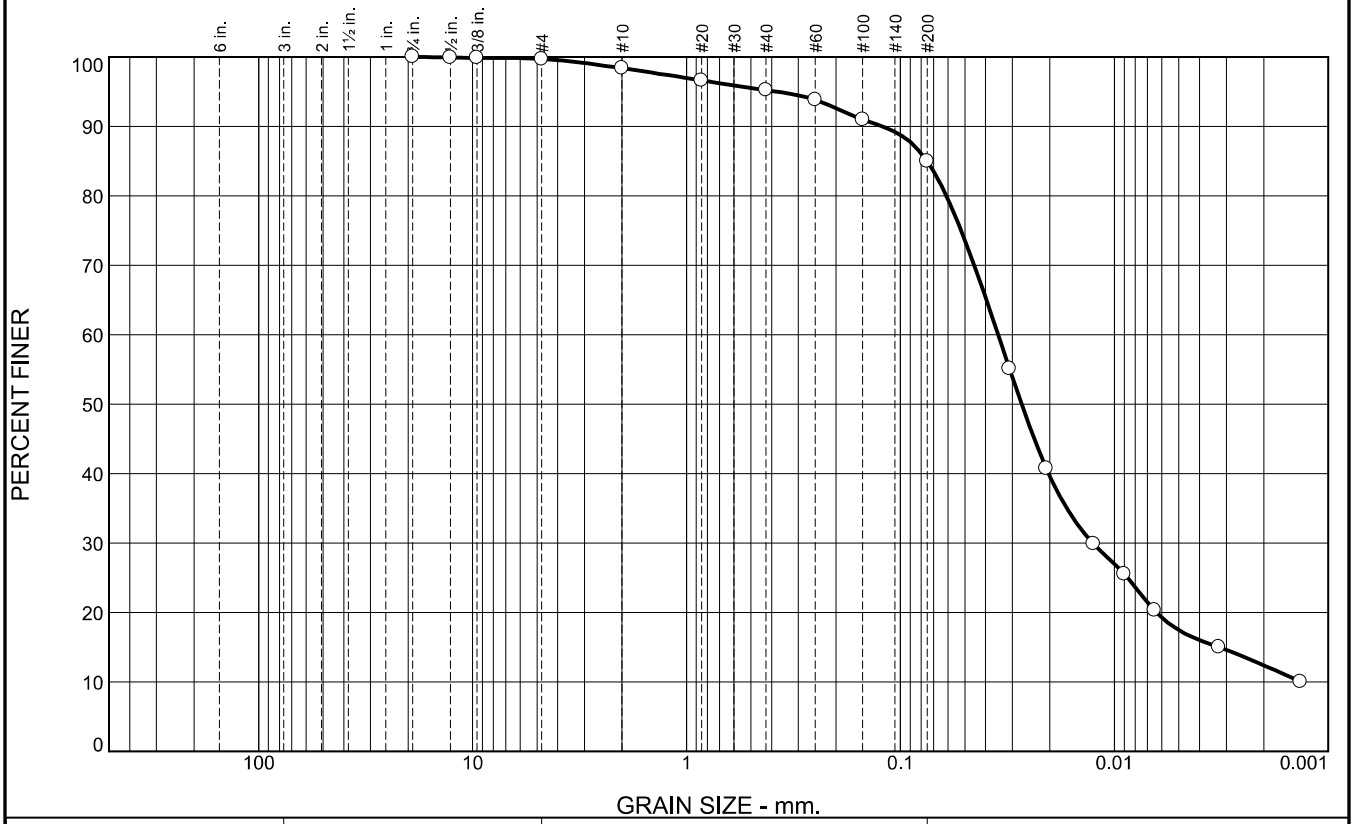


Sieve Analysis ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	1.3	3.2	10.2	67.5	17.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	99.9		
3/8	99.9		
#4	99.7		
#10	98.4		
#20	96.6		
#40	95.2		
#60	93.8		
#100	90.9		
#200	85.0		

* (no specification provided)

Material Description

Brown SILT, trace to some sand

Atterberg Limits

PL= 23 LL= 28 PI= 5

Coefficients

D_{90}= 0.1219 D_{85}= 0.0752 D_{60}= 0.0350
D_{50}= 0.0271 D_{30}= 0.0126 D_{15}= 0.0032
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(4)

Remarks

Combined subgrade sample from B-1 and B-3 at test depth of about 0.5 feet to 2.5 feet

Source of Sample: 8386 **Depth:** 0.5'-2.5'
Sample Number: B-1/B-3 **Date:**

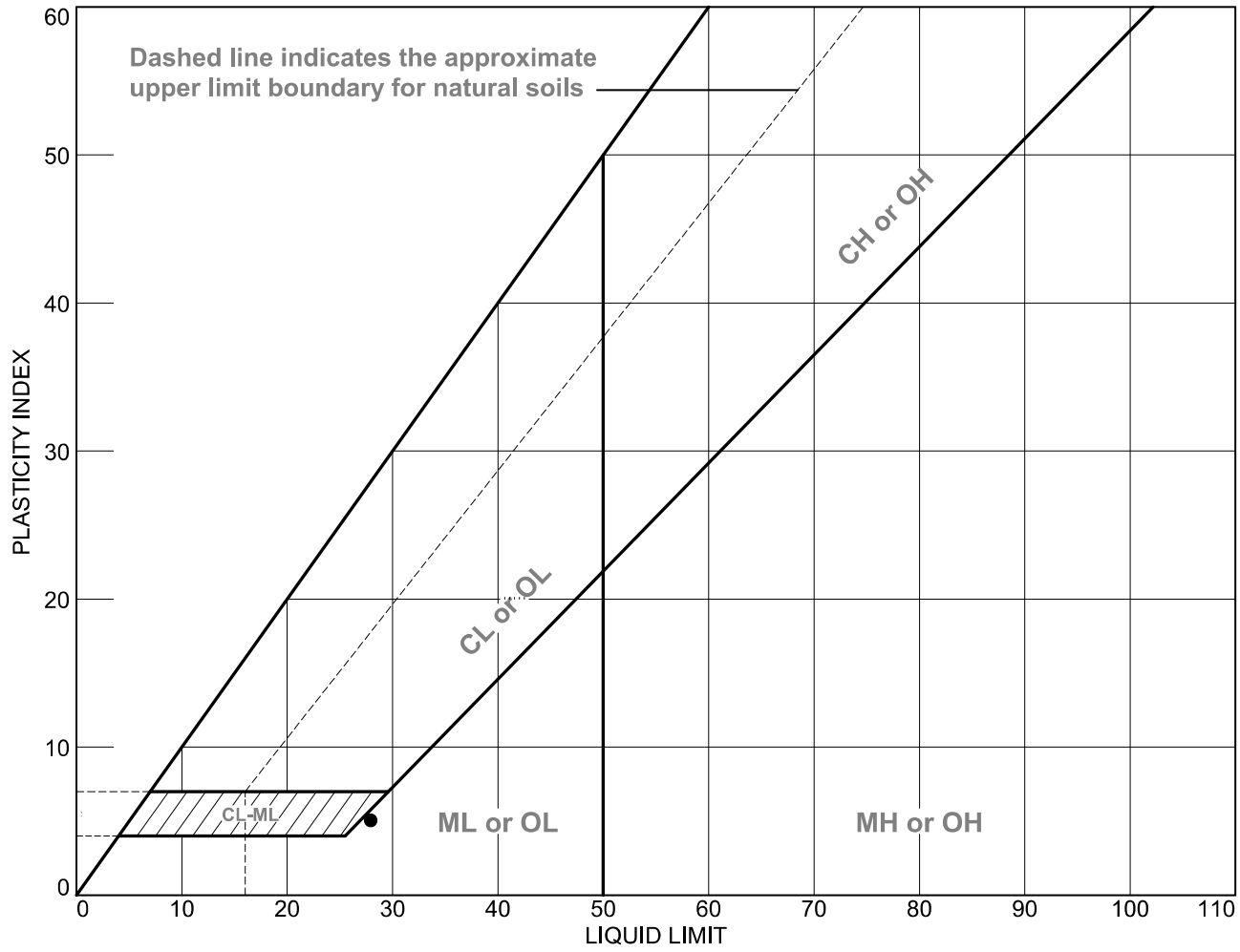
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: GRI
Project: Eastern Oregon Regional Airport at Pendleton

Project No: 2216226-601 **Figure** 19A

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	8386	B-1/B-3	0.5'-2.5'	13.3	23	28	5	ML

FEI Testing & Inspection, Inc.

Corvallis, OR

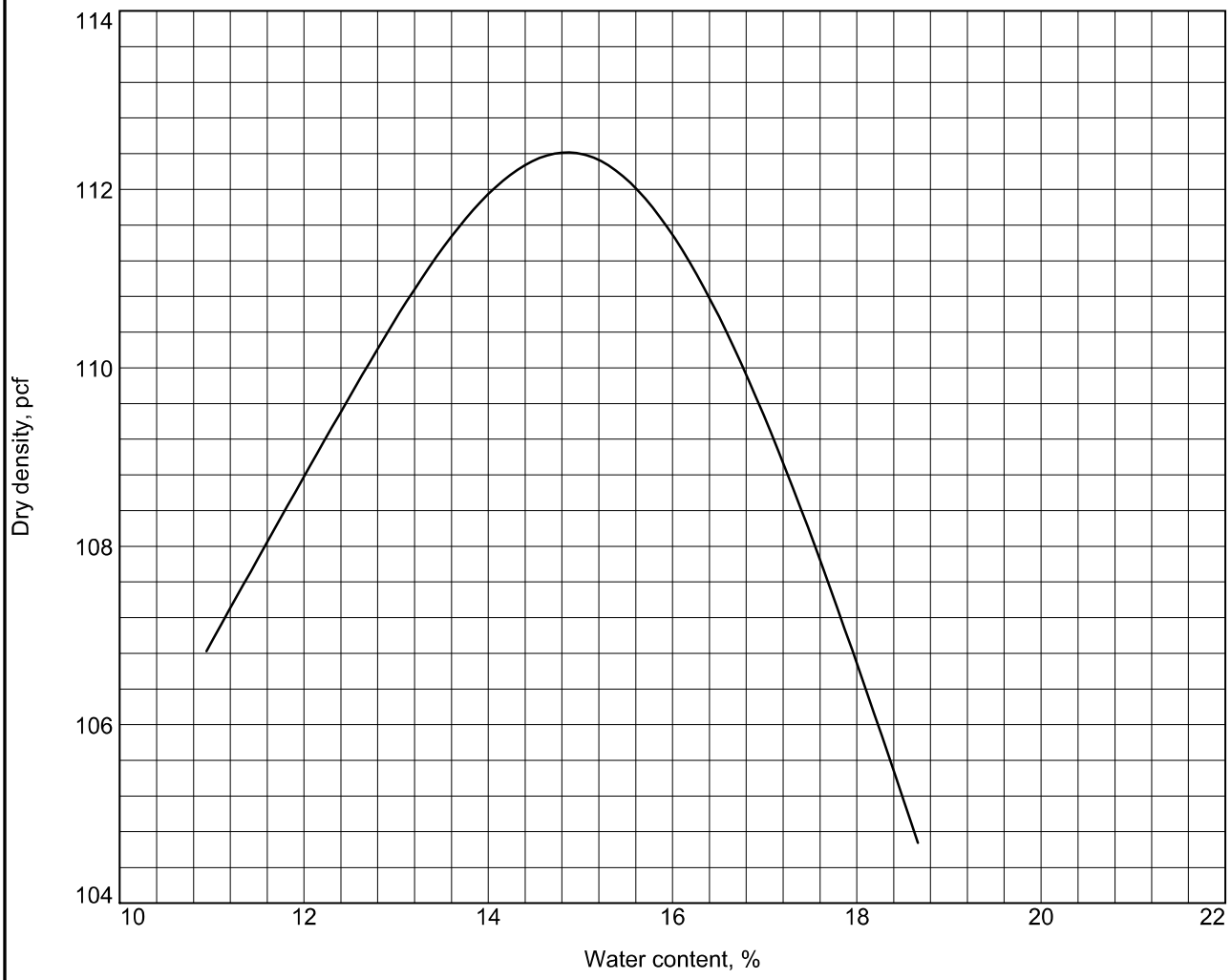
Client: GRI

Project: Eastern Oregon Regional Airport at Pendleton

Project No.: 2216226-601

Figure 20A

MOISTURE - DENSITY RELATIONSHIP CURVE



Test specification: ASTM D 1557-12 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.5'-2.5'	ML	A-4(4)	13.3		28	5	0.3	85.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 112.4 pcf Optimum moisture = 14.9 %	Brown SILT, trace to some sand

Project No. 2216226- **Client:** GRI

Project: Eastern Oregon Regional Airport at Pendleton

○**Source of Sample:** 8386 **Sample Number:** B-1/B-3

Remarks:

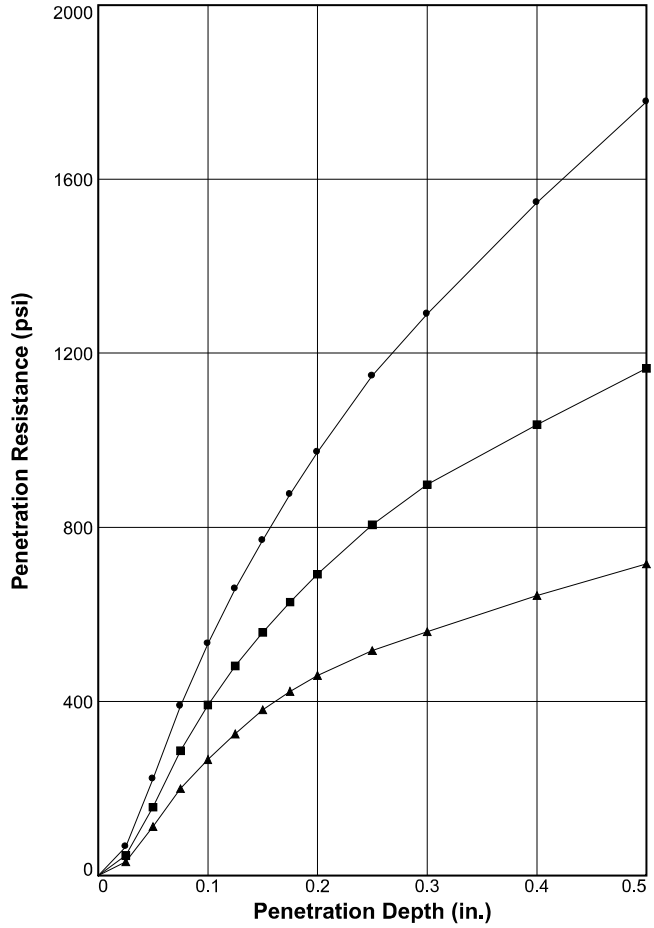
Date: 11-23-2021

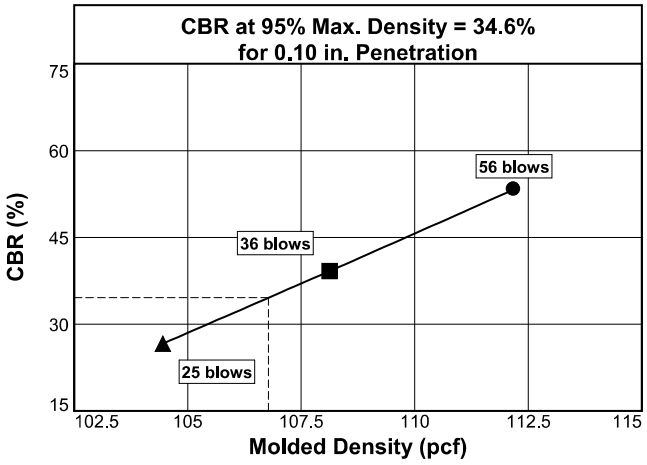
Combined subgrade sample from B-1 and B-3 at test depth of about 0.5 feet to 2.5 feet

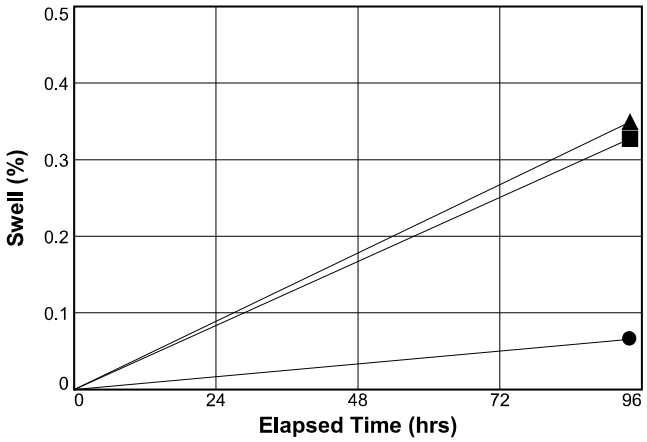
FEI Testing & Inspection, Inc.
Corvallis, OR

Figure 21A

BEARING RATIO TEST REPORT
ASTM D1883-05







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	112.2	99.8	14.3	112.1	99.7	18.5	53.3	64.8	0.000	32	0.1
2 △	104.5	93	14.5	104.1	92.6	20.8	26.6	30.7	0.000	32	0.3
3 □	108.1	96.2	14.8	107.8	95.9	19.7	39.2	46.1	0.000	32	0.3

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Brown SILT, trace to some sand	ML	112.4	14.9	28	5

Project No: 2216226-601

Project: Eastern Oregon Regional Airport at Pendleton

Source of Sample: 8386 **Depth:** 0.5'-2.5'

Sample Number: B-1/B-3

Date:

BEARING RATIO TEST REPORT
FEI Testing & Inspection, Inc.
Corvallis, OR

Test Description/Remarks:

Combined subgrade sample from B-1 and B-3 at test depth of about 0.5 feet to 2.5 feet

Figure 22A

Geotechnical Investigation

Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation

Pendleton, Oregon

Prepared for:

Precision Approach Engineering, Inc.
Pendleton, Oregon

May 12, 2021

Foundation Engineering, Inc.

Professional Geotechnical Services

Foundation Engineering, Inc.
Professional Geotechnical Services

Tracy May, P.E.
Precision Approach Engineering, Inc.
5125 SW Hout Street
Corvallis, Oregon 97333

May 12, 2021

Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Geotechnical Investigation
Pendleton, Oregon

Project No.: 2211022

Dear Mr. May:

We have completed the requested geotechnical investigation for the above-referenced project. Our report includes a description of our work, a discussion of the site conditions, and a summary of laboratory testing. Design parameters and geotechnical recommendations for the proposed new pavements and pavement rehabilitation are provided herein.

There are numerous values in geotechnical investigations that are approximate, including calculated values, measured lengths, soil layer depths and elevations, and strength measurements. For brevity, the symbol "±" is used throughout this report to represent the words approximate or approximately when discussing approximate values.

It has been a pleasure assisting you with this phase of your project. Please do not hesitate to contact us if you have any questions or if you require further assistance.

Sincerely,

FOUNDATION ENGINEERING, INC.

David L, Running, P.E., G.E.
Senior Geotechnical Engineer

DLR/mm
enclosures

GEOTECHNICAL INVESTIGATION

EASTERN OREGON REGIONAL AIRPORT – PENDLETON
TAXILANES AND APRON REHABILITATION
PENDLETON, OREGON

BACKGROUND

The Eastern Oregon Regional Airport is planning improvements that include rehabilitation of an existing apron adjacent to Taxiway G and south of Taxiway F, and rehabilitation and construction of new or existing taxilanes servicing hangars west of the main tie-down apron. Other improvements at the airport will include new hangars north of Taxiway D and the future development for an unmanned aircraft systems (UAS) facility at the north end of the airport. This report focuses on the apron and taxilane improvements. The other project elements are addressed in separate reports.

The airport location is shown on Figure 1A (Appendix A). A layout of the project area where taxilane improvements are planned is shown on Figure 2A, and the apron improvement area is shown on Figure 3A (Appendix A). Precision Approach Engineering, Inc. (PAE) provided a figure identifying each of the improvement areas, which is also included in Appendix A.

PAE is the prime engineering consultant for the project and will provide pavement design services. Foundation Engineering, Inc. was retained by PAE to perform the subsurface investigation, conduct laboratory testing, and provide recommendations for pavement design parameters associated with the planned improvements. Foundation Engineering teamed with PAE for previous work at the airport that includes the recent Runway 7-25 rehabilitation. Relevant information from our previous project has been used to supplement the current work, where applicable.

SITE CONDITIONS AND LOCAL GEOLOGY

The Eastern Oregon Regional Airport is located northwest and uphill from Pendleton's city center on a relatively flat plateau. Local geologic mapping (e.g., Walker 1972 and Walker and MacLeod 1991) indicates the airport is underlain by loess (i.e., wind-blown silt and fine sand) followed by Columbia River Basalt. The depth to bedrock varies and current explorations did not encounter rock within 10 feet of the ground surface. Additional details of the subsurface conditions are discussed below.

FIELD EXPLORATION

We completed a field investigation on March 9, 2021, that included a combination of pavement cores, borings, and test pits to document the subsurface conditions for the various project elements. Explorations within the pavement improvement areas included ten pavement cores (C-1 through C-10), one boring (BH-1), and four

test pits (TP-1 through TP-4). The approximate exploration locations are shown on Figures 2A and 3A.

Pavement Cores

Pavement cores C-1 through C-4 were completed in the taxilanes that access existing hangars west of the tie-down apron. C-5 through C-7 were completed along Taxiway D, north of the tie-down apron. C-8 through C-10 were completed in the apron rehabilitation area east of Taxiway G.

The pavement cores were completed using a 5-inch diameter core drill and trailer-mounted drill rig. At each location, the AC cores were removed and the base rock and underlying subgrade was excavated using a solid-stem auger or hollow-barrel drilling attachment. Each of the explorations extended to a depth of ±5 feet below the paved surface.

The core holes were logged to delineate the thickness of the AC and the base materials, and to identify the subgrade conditions. The core hole logs are included in Appendix B. Dynamic Cone Penetrometer (DCP) testing was performed on the base rock and subgrade in each core hole and is described in a subsequent section of this report.

Following the completion of the explorations, the core holes were backfilled with the excavated materials, placed and compacted in thin lifts, and capped with granular fill and AC cold patch.

Boring

Boring BH-1 was drilled north of Taxiway D in an area where new hangars are planned. The boring was completed using the trailer-mounted drill rig equipped with a solid-stem auger.

Drilling at BH-1 extended to a maximum depth of ±9 feet before reaching practical drilling refusal in cemented silt. Disturbed soil samples were obtained by driving a split-spoon sampler. The Standard Penetration Test (SPT), which is run when the split-spoon is driven, provides an indication of the density or stiffness of the soil. The samples were obtained at 2.5-foot intervals.

Upon completion, BH-1 was backfilled with a combination of bentonite chips and soil cuttings and capped with sod to match the surrounding terrain.

Test Pits

Test pits TP-1 and TP-2 were located west of the existing taxilanes where new taxilane extensions and future hangars are planned. TP-3 and TP-4 were located north of Taxiway D (see Figure 2A).

The test pits were excavated using a Kubota KX91-3 tracked excavator and extended to maximum depths ranging from ±5.5 to 8 feet. At each location, the soil profiles were logged and disturbed samples were obtained for possible laboratory testing. Following the exploration, the excavated material was placed back into the test pits and the ground was graded relatively smooth.

The subsurface conditions are summarized on the appended logs (Appendix B). The logs were prepared based on a review of the field logs and laboratory test results, and an examination of the soil samples in our office. Photos of the AC pavement cores are also included in Appendix B.

DISCUSSION OF SUBSURFACE CONDITIONS

Pavement Sections

Taxilanes. The pavement cores within the taxilane improvement area (C-1 through C-7) encountered ±2 to 6.5 inches of AC. The thickest AC was encountered on Taxiway D, where AC thicknesses of ±6.5 and ±4.5 inches were measured at C-6 and C-7, respectively.

The AC is underlain by base rock and/or granular fill that varies somewhat with location. Explorations C-1 through C-5 encountered ¾-inch minus crushed rock with variable silt and sand content. C-6 and C-7 encountered 1½-inch minus crushed gravel. Unified Soil Classification System (USCS) classifications for the base material include GW, GP, GP-GM, GM, and SM to GM. The thickness of the base material ranged from ±7 to 19.5 inches. Total pavement section thicknesses (including the AC and base material) ranged from ±9 to 22 inches.

Apron. The pavement cores within the apron improvement area (C-8 through C-10) encountered ±2 to 4.5 inches of AC. The AC is underlain by base rock consisting of ¾-inch minus crushed rock with trace to some silt and USCS classification of GP to GP-GM. The thickness of the base rock ranged from ±7.5 to 8 inches. Total pavement section thicknesses (including the AC and base material) ranged from ±10 to 12 inches.

Pavement section thicknesses measured at each of the pavement core locations are summarized on Table 1B (Appendix B).

Subgrade

The subgrade soils are relatively uniform across the site, generally consisting of light brown to dark brown, non-plastic silt with trace to some fine sand (loess) (USCS classification ML). Weakly to moderately cemented soils (caliche) were encountered in the test pits and boring at depths ranging from ±4 to 8 feet. The cemented soils were hard enough to cause practical digging refusal in TP-1 and TP-2 and drilling refusal in BH-1 at the bottom of the explorations.

Groundwater

No groundwater was encountered to the maximum depth of the explorations completed within the pavement improvement areas. Additionally, no groundwater was encountered in current or previous explorations for other project elements.

Shallow groundwater is likely not a typical condition at the airport given the airport's location on a high plateau and the area's semi-arid climate with limited rainfall. Perched groundwater conditions may occur on occasion at shallow depths after heavy rain or snow (or during snow melt) due to the presence of cemented soils at relatively shallow depths (i.e., ±4 to 8 feet).

FIELD AND LABORATORY TESTING

DCP Testing

Dynamic Cone Penetrometer (DCP) testing was completed on the base rock and subgrade in each of the core holes. The DCP test consists of driving the cone of the DCP apparatus into the soil and recording the penetration versus blow count (mm/blow) as the DCP value. The 2020 FAA Draft Airport Pavement Design and Evaluation Circular (AC 150/5320-6G) provides several possible correlations for estimating the in-situ resilient modulus or CBR value from DCP test results. The various correlations rely, in part, on soil classification and expected range of CBR values. The Oregon Department of Transportation (ODOT) Pavement Design Guide (2019) also provides a correlation for estimating the in-situ resilient modulus. The ODOT correlation equation is less sensitive to variations in DCP blow count and ODOT has recommended their correlation for use in Oregon. The DCP test results and correlated in-situ subgrade modulus values are summarized in Table 1C (Appendix C) based on ODOT guidelines.

DCP testing on base rock and similar gravelly soil is less reliable compared to sandy or fine-grained soils. Therefore, base rock moduli are not reported herein (but are shown in Table 1C). In-situ subgrade modulus values ranging from ±3,523 psi to 8,103 psi were calculated for the subgrade, with an average value of ±4,962 psi. The 2016 FAA Airport Pavement Design and Evaluation Circular (AC No. 150/5320-6F) and draft circular (AC 150/5320-6G) recommend estimating the subgrade modulus based on the following correlation with laboratory California Bearing Ratio (CBR) tests:

$$E = 1{,}500 \times CBR$$

Based on the above equation, we back-calculated in-situ CBR values ranging from ±2.3 to 5.4 for the subgrade, with an average value of ±3.3.

The subgrade moduli and correlated CBR values from DCP testing are similar but slightly lower than the results of previous testing along Runway 7-25. The test results also vary between the taxilanes and apron. DCP testing in the taxilane explorations (C-1 through C-7) indicated an average modulus value of ±4,376 psi and correlated average CBR value of ±2.9. DCP testing in the apron explorations

(C-8 through C-10) indicated and average modulus value of ±6,328 psi and correlated average CBR value of ±4.2.

Laboratory Testing

Index Tests. The laboratory work included moisture content and fines content determinations and mechanical sieve and hydrometer analyses to classify the soils and estimate their overall engineering properties. The test results are summarized on Table 2C and Figures 1C through 6C (Appendix C). Atterberg limits tests were attempted on two subgrade samples (S-3-1 and C-4-3). However, the tests indicated the samples are non-plastic (noted as NP in Table 2C).

Moisture-Density and CBR Testing. A modified effort moisture-density curve (ASTM D1557) was developed for the bulk sample obtained from TP-1 (S-1-1). The results are summarized in Figure 7C (Appendix C). The test results indicate a maximum dry density of 110.8 pcf at an optimum moisture content of 14.8%.

A California Bearing Ratio (CBR, ASTM D1883) test was completed on the same sample using the results from the moisture-density test to prepare samples ranging from ±91 to 101% relative compaction. The results, summarized in Figure 8C (Appendix C), indicate a CBR value of 29.2 at 95% relative compaction.

CBR and moisture-density test results from current and previous projects at Pendleton Airport are summarized in Table 3C for comparison. This includes another current test completed within the planned UAS development (sample S-5-1). The current moisture-density and CBR results are somewhat higher compared to the tests completed for the runway rehabilitation project. However, all the test results indicate relatively high CBR values for the compacted subgrade. Additional discussion and recommendations for design CBR values are provided in the following section of this report.

DISCUSSION OF GEOTECHNICAL CONSIDERATIONS AND DESIGN REQUIREMENTS

We understand the preferred rehabilitation option for the apron will be to grind and overlay the existing section. The taxilane improvements will include a combination of new construction and rehabilitation. The taxilane rehabilitation may include full-depth reconstruction or an overlay. Design parameters for new and overlay pavements are discussed herein.

Discussion of Subgrade Conditions

The subgrade is relatively uniform across the airport, consisting predominantly of non-plastic silt with trace to some fine sand. A USCS classification ML is appropriate for this soil. Appendix A of the FAA Pavement Advisory Circular (AC 150/5320-6F) indicates that soils designated as ML are "fair to good" as a foundation material when not subject to frost action. Frost-susceptibility is discussed in a subsequent section of this report.

Parameters for Pavement Overlay

Subgrade. Where pavement overlay is planned, the subgrade will remain in its present condition. Therefore, the results of the DCP testing are most suitable for evaluating the subgrade support. The FAA Pavement Advisory Circular (AC 150/5320-6F) recommends conservatively selecting a design value that is one standard deviation below the mean test value.

For the apron adjacent to Taxiway G, the DCP tests indicated a mean resilient modulus of 6,328 psi with a standard deviation of 1,623 psi. Based on these values, we recommend using a design modulus of 4,700 psi or a corresponding design CBR of 3.1 to evaluate the pavement overlay.

For the taxilanes west of the main tie-down apron, the DCP tests indicated a mean resilient modulus of 4,376 psi with a standard deviation of 735 psi. Based on these values, we recommend using a design modulus of 3,600 psi or corresponding design CBR of 2.4 to evaluate the pavement overlay.

The recommended design subgrade resilient modulus and/or CBR value for pavement overlay (based on in-situ DCP testing) is significantly lower than the laboratory CBR test values reported above and in Table 3C. We anticipate the low in-situ modulus is likely due to limited subgrade compaction and testing when the existing apron and taxiway pavements were constructed.

Base Rock. The existing base rock consists primarily of crushed rock or crushed gravel with varying silt and sand content. The gradation tests indicate the fines content (i.e., percent passing the No. 200 sieve) is greater than 10 percent for some of the tested samples. Based on the variability of the existing base materials, we recommend modeling it as Subbase Course (Item P-154) for analysis in FAARFIELD. The design should also consider the varying thickness of the existing base rock layer across the project area.

Existing AC. FAARFIELD default material parameters for the AC (P-401/403) should be suitable for evaluating overlay and/or milling and overlay options. However, any overlay evaluation must also take into consideration the thickness and wear of the existing AC.

For constructability, FAA typically requires leaving a minimum of 2 inches of existing AC in place when milling. In some areas, the AC wearing course is presently only 2 inches thick (e.g., see pavement cores for C-2 and C-8).

Parameters for New Pavement Design and Subgrade Preparation

Subgrade Design Parameters. The current and previous laboratory testing indicate a range of CBR values for the silt subgrade. However, all the CBR values are relatively high for samples compacted to 95% relative compaction (based on ASTM D1557). Considering all the test results, we recommend assuming a design CBR value of 15 for new pavements constructed on compacted subgrade.

Subgrade Preparation. In areas with new pavements and/or where full-depth reconstruction are planned, subgrade preparation should follow the requirements for Item P-152 as summarized in the most recent FAA Standard Specifications for Construction of Airports Circular (AC No. 150/5370-10). The earthwork and compaction criteria should assume the subgrade will consist of non-cohesive soil (i.e., PI<3).

The soils encountered across the site are moisture-sensitive and will require careful moisture control. We recommend compacting the subgrade at or slightly dry of optimum moisture to reduce the risk of pumping. The moisture in the finished subgrade should be maintained and the subgrade should be backfilled with base rock or subbase as soon as practical to limit moisture fluctuations (i.e., wetting or drying).

It has been our experience that subgrade covered by existing pavements can remain wet of optimum year-round. Therefore, if complete reconstruction is planned, wet subgrade should be anticipated beneath the existing pavements regardless of the construction season. The construction schedule should include ample time to aerate and moisture-condition the soils prior to compaction.

Frost Considerations

The subgrade consists of silt with trace to some sand and corresponding USCS soil classification ML. Therefore, an FG-4 FAA frost group classification is appropriate. FG-4 subgrade is considered highly frost-susceptible.

Complete mitigation of the risk of detrimental frost heave typically requires overexcavation and replacement of the frost-susceptible soils below the depth of frost penetration. The local building code in Umatilla County indicates a design frost penetration depth of 24 inches (referenced in Table R301.2(1) of the 2017 Oregon Residential Specialty Code). Providing drainage to prevent the accumulation of water in the subgrade is also beneficial to reduce the risk of frost heave.

As an alternative to complete frost protection, FAA provides an option for partial mitigation where the pavement section extends to at least 65 percent of the anticipated frost penetration depth. This would correspond to a structural section thickness of at least 16 inches.

Site Drainage

The 2016 FAA Pavement Advisory (AC 150/5320 6E), Appendix A, indicates soil classified as ML can have drainage characteristics ranging from fair to poor. The 2013 FAA Surface Drainage Design Advisory Circular (AC 150/5320-5D), Figure G-3, suggests coefficient of permeability, *k*, values in the range of 10^{-4} cm/sec to 10^{-8} cm/sec. The actual permeability will depend on multiple factors such as soil density and clay content (i.e., plasticity). Based on our experience with similar soils, we recommend assuming a *k* value no greater than 10^{-5} cm/sec for the silt subgrade. Infiltration testing may be performed to validate a higher *k* value.

Construction Considerations

Construction Timing. If full-depth reconstruction is planned for any portion of the taxilane or apron rehabilitation, it will expose the underlying subgrade, which will likely be wet of optimum. In this case, we recommend completing the earthwork during the dry summer months (typically July through the end of September), when it should be practical to adjust the moisture content of the soil to near optimum and compact the subgrade. The contractor may still experience pumping problems and have difficulty achieving adequate compaction in the summer if the soils have not adequately dried.

The silt will be moisture-sensitive and will soften considerably when wet. Compaction of the subgrade will not be practical during wet weather. Therefore, if construction during wet weather is necessary, it will likely require a thickened subbase and/or base rock section to reduce the potential for subgrade disturbance. We typically recommend a minimum of 18 to 24 inches of granular fill over a separation geotextile to reduce the risk of subgrade pumping. A reduced subgrade design strength would also be necessary for design with uncompacted subgrade.

Reclamation of Existing Materials. If pavement materials are excavated as part of a full-depth pavement reconstruction, we believe the excavated materials could be suitable as a recycled asphalt pavement (RAP) subbase course (Item P-154). However, the use of this material as subbase may require mixing and/or processing to meet gradation requirements as defined in Item P-154. Furthermore, additional cleaner aggregate may be required to mix with the existing RAP if the fines content (i.e., passing the No. 200 sieve) of the processed material is greater than 10 percent.

Material Specifications and Compaction

The base rock for new pavements should consist of ¾ or 1-inch minus, clean (i.e., less than 5% passing the No. 200 sieve), well-graded, crushed gravel or rock conforming to FAA P-208 or P-209 requirements. Subbase should consist of free-draining sand, gravel, rock, asphalt grindings, or mixtures of the above that conform to FAA P-154 requirements and are free of plastic clay and organic matter.

Stabilization Fill, if required to mitigate soft and/or overly wet soil conditions, should consist of 3-inch minus, clean (i.e., less than 5% passing the No. 200 sieve), well-graded, angular, crushed (quarry) rock. Stone Embankment Fill as defined in the Oregon Standard Specification for Construction, Section 00330.16 (ODOT 2021) may be specified with the alteration that a maximum particle size of 3 inches is required. The gradation of the Stabilization Fill meets the requirements for subbase (Item P-154) and may be substituted for subbase where overexcavation is required. The percent fractured faces for the angular material should meet the requirements for Item P-208 or P-209, but may be confirmed by visual observation.

A separation geotextile placed over the finished subgrade will facilitate placement of the base materials and limit migration of the fine-grained subgrade into the base rock or subbase for long-term frost protection. The separation geotextile should

consist of a woven or non-woven geotextile with Mean Average Roll Value (MARV) strength properties meeting the requirements of an AASHTO M 288-17 Class 2 geotextile. The geotextile should have MARV hydraulic properties meeting the requirements of AASHTO M 288-17, Table 3 with a permittivity greater than 0.05 $sec.^{-1}$ and an Apparent Opening Size (AOS) less than 0.6 mm (max average roll value).

All fill should be placed in level lifts and compacted based on FAA requirements for the selected material type. The moisture content of the fill should be adjusted to within ±2% of its optimum value prior to compaction. Efficient compaction of fine-grained soils (where appropriate) will typically require the use of a padfoot or kneading roller to achieve the required compaction. Granular fill (sand, rock, or gravel) will compact most efficiently with a smooth drum, vibratory roller.

Field density tests should be run frequently to confirm adequate compaction of the base rock, subbase, and subgrade. Adequate compaction of fill materials, which are too coarse or too variable for density testing (e.g., Stabilization Fill), should be evaluated by observation of the compaction method and proof-rolling with a loaded dump truck or other approved heavy construction vehicle.

DESIGN REVIEW/CONSTRUCTION OBSERVATION/TESTING

We should be provided the opportunity to review all drawings and specifications that pertain to site preparation and fill placement. Site preparation for new pavements will require field confirmation of the subgrade conditions. Mitigation of pumping subgrade and fill will also require engineering review and judgment. That judgment should be provided by one of our representatives. We recommend we be retained to provide the necessary construction observations.

VARIATION OF SUBSURFACE CONDITIONS, USE OF THIS REPORT AND WARRANTY

The analysis, conclusions, and recommendations contained herein assume the soil profiles encountered in the explorations are representative of the site conditions. The above recommendations assume we will have the opportunity to review final drawings and be present during construction to confirm the assumed subgrade conditions. No changes in the enclosed recommendations should be made without our approval. We will assume no responsibility or liability for any engineering judgment, inspection, or testing performed by others.

This report was prepared for the exclusive use of Precision Approach Engineering and their design consultants for the Eastern Oregon Regional Airport – Pendleton: Taxilanes and Apron Rehabilitation project in Pendleton, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This report is intended for planning and design purposes. Contractors using this information to estimate construction quantities or costs do so at their own risk. Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or

groundwater by hazardous or toxic materials. We assume those services, if needed, have been completed by others.

Our work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

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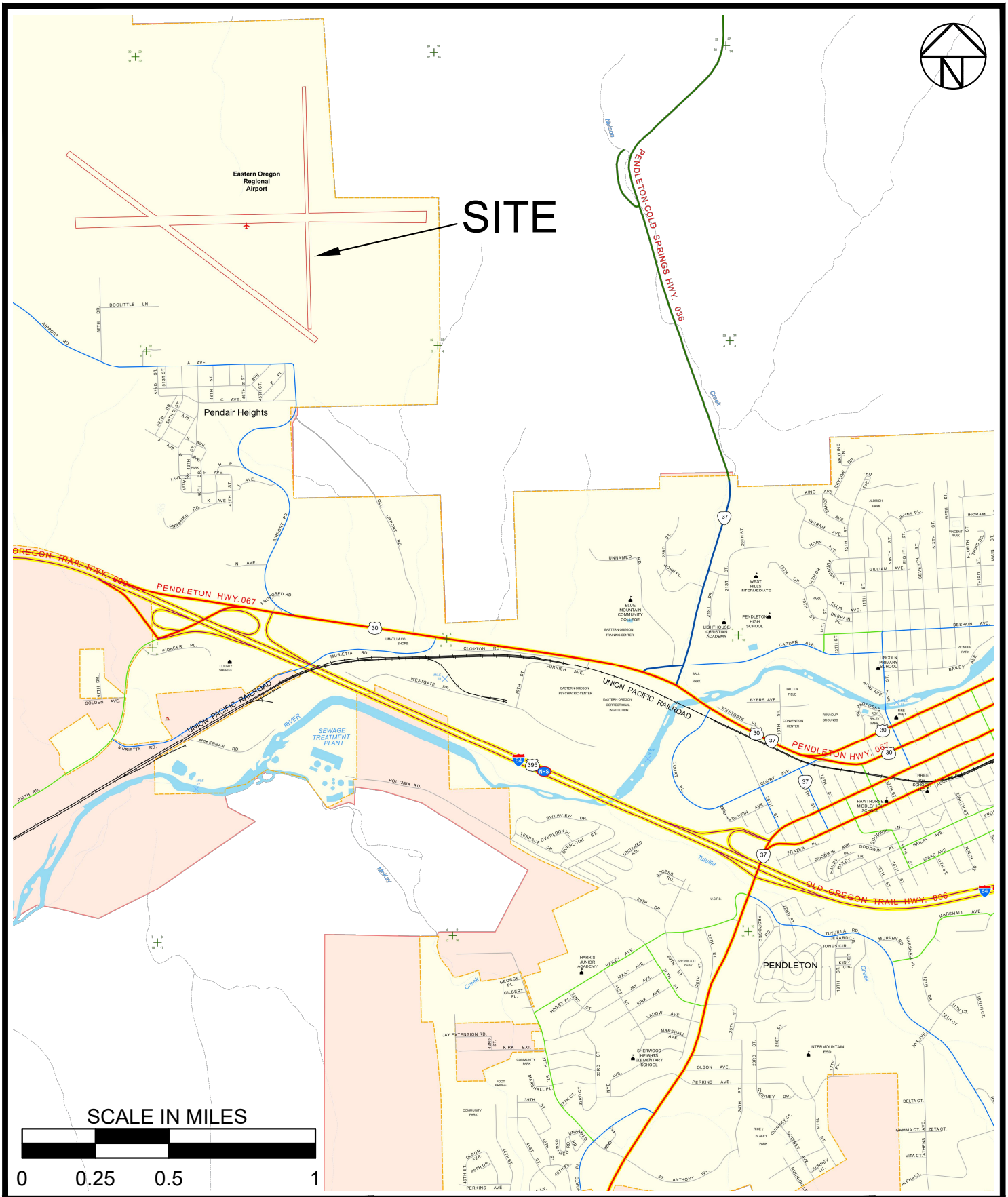
Appendix A

Figures

Professional
Geotechnical
Services

Foundation Engineering, Inc.



Foundation Engineering, Inc. Professional Geotechnical Services	VICINITY MAP	FIGURE NO.
	EASTERN OREGON REGIONAL AIRPORT - PENDLETON Taxilanes and Apron Rehabilitation Pendleton, Oregon	1A

PROJECT NO.	DATE:	DRAWN BY:
2211022	March 2021	JCH

FILE:P:\Projects\2021 Jobs\2211022 - Pendleton Airport-Taxilane\Drawing\Figure1A.dwg

NOTES:
1. THE EXPLORATION LOCATIONS WERE ESTABLISHED BY MEASURING RELATIVE TO ONSITE LANDMARKS AND ARE APPROXIMATE ONLY.
2. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.
3. AERIAL PHOTO USED FOR THE BASE MAP WAS OBTAINED FROM GOOGLE EARTH. SCALE IS APPROXIMATE.

Foundation Engineering, Inc.
Professional Geotechnical Services

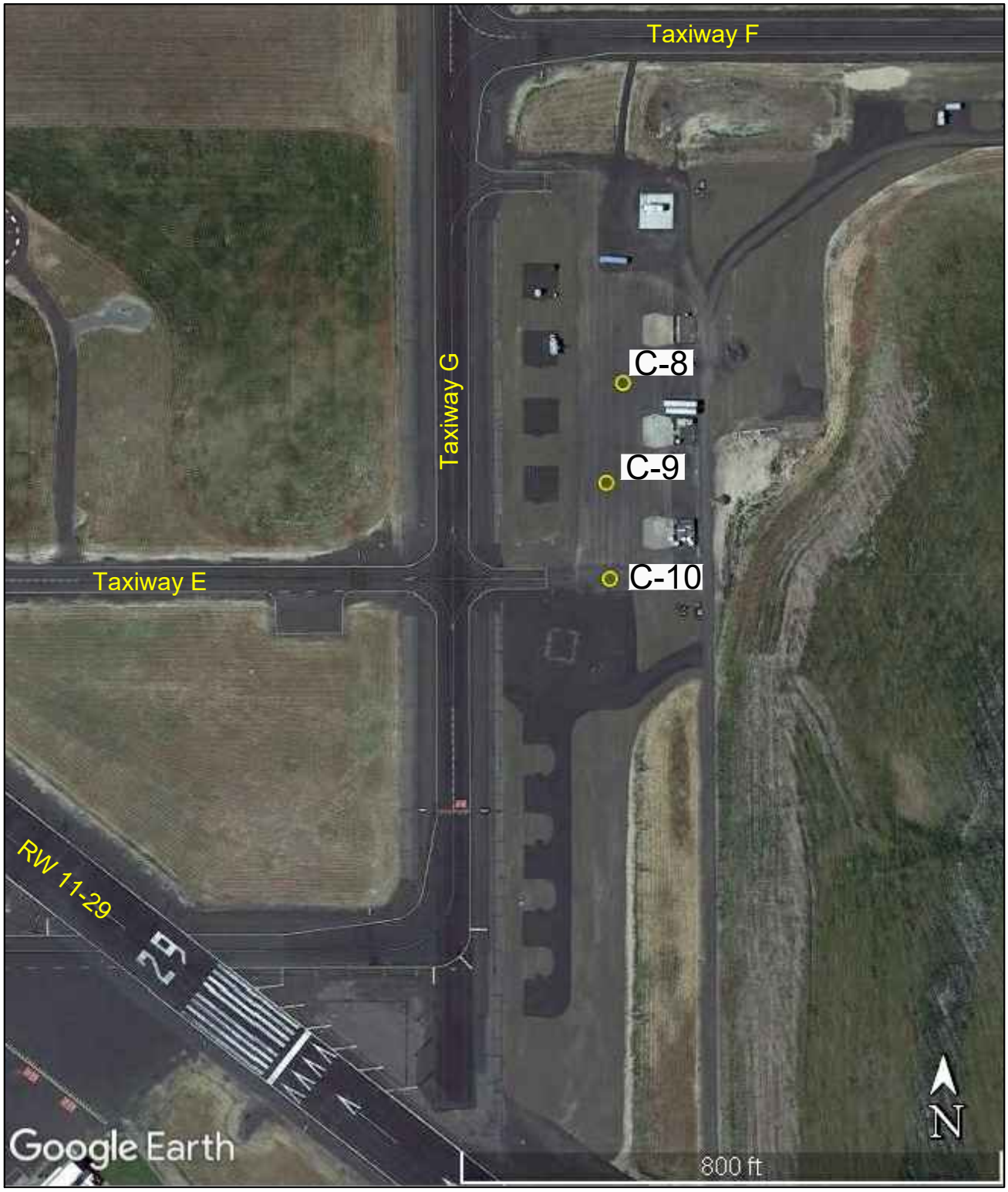
PROJECT NO.	DATE:	DRAWN BY:
2211022	March 2021	JCH

SITE LAYOUT AND EXPLORATIONS

EASTERN OREGON REGIONAL AIRPORT - PENDLETON
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

FIGURE NO.
2A

FILE: Pendleton Explorations.dwg



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1. THE EXPLORATION LOCATIONS WERE ESTABLISHED BY MEASURING RELATIVE TO ONSITE LANDMARKS AND ARE APPROXIMATE ONLY.
2. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.
3. AERIAL PHOTO USED FOR THE BASE MAP WAS OBTAINED FROM GOOGLE EARTH. SCALE IS APPROXIMATE.

Foundation Engineering, Inc.
Professional Geotechnical Services

PROJECT NO.	DATE:	DRAWN BY:
2211022	March 2021	JCH

SITE LAYOUT AND EXPLORATIONS

EASTERN OREGON REGIONAL AIRPORT - PENDLETON
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

FIGURE NO.
3A

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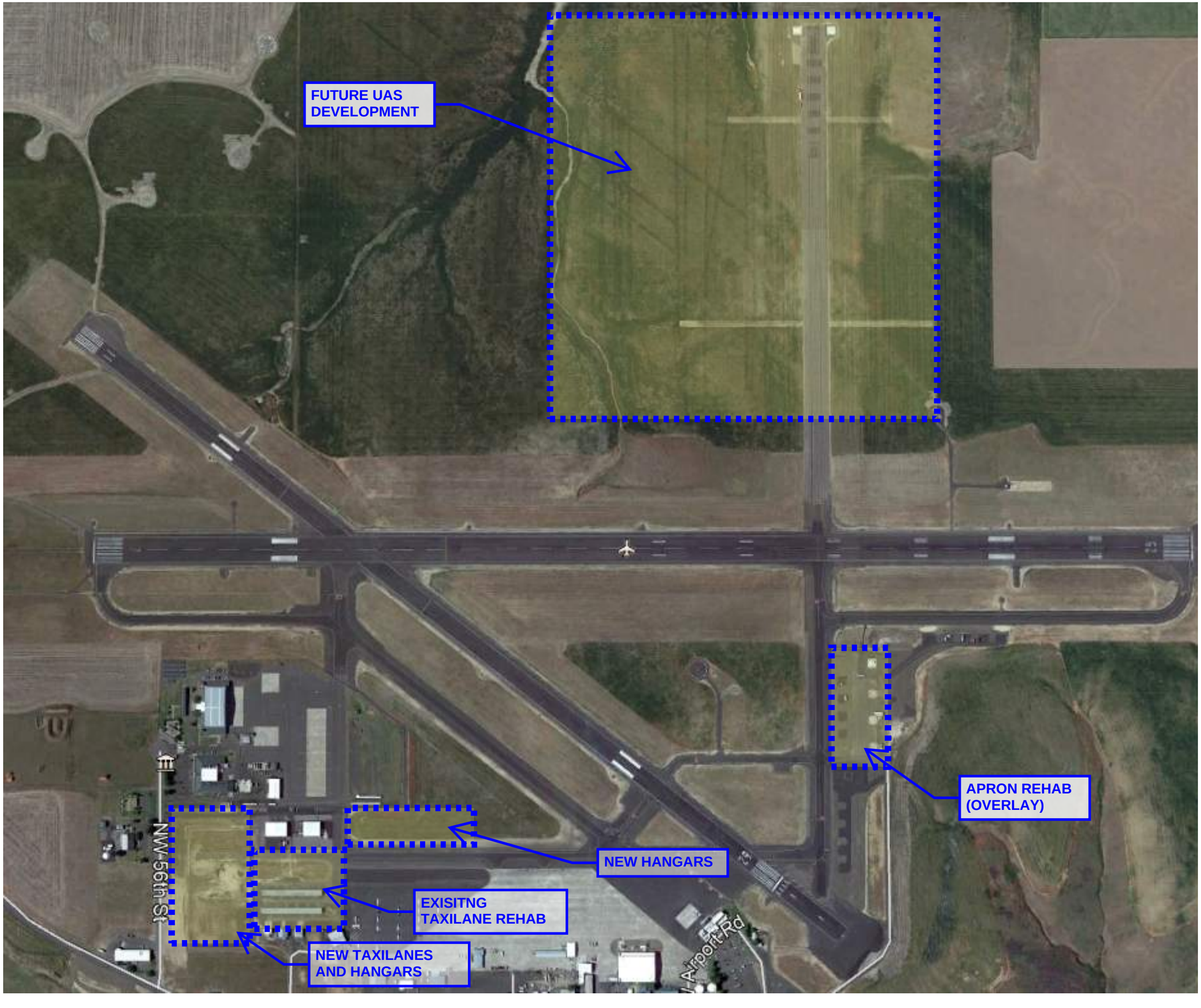

NORTH

NTS

PRECISION APPROACH ENGINEERING
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EASTERN OREGON REGIONAL AIRPORT - PENDLETON

DECEMBER 2020

Appendix B

Test Pit, Boring, and Core Hole Logs and Core Photos

Professional Geotechnical Services

Foundation Engineering, Inc.

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the sample examinations and laboratory test results. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

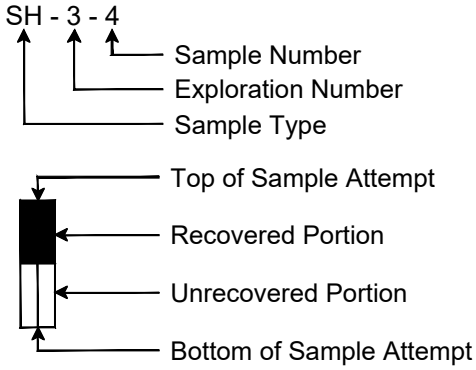
VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS



C - Pavement Core Sample
CS - Rock Core Sample
OS - Oversize Sample (3-inch O.D. split-spoon)
S - Grab Sample
SH - Thin-walled Shelby Tube Sample
SS - Standard Penetration Test Sample (2-inch O.D. split-spoon)

▲ Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split-spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

● Water Content (%)

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or Field Vane shear devices.

WATER TABLE

▼ Water Table Location

(1/31/16) Date of Measurement

TYPICAL SOIL/ROCK SYMBOLS

Concrete	Silt	Basalt
Organics	Sand	Sandstone
Clay	Gravel	Siltstone

UNIFIED SOIL CLASSIFICATION SYMBOLS

G - Gravel	W - Well Graded
S - Sand	P - Poorly Graded
M - Silt	L - Low Plasticity
C - Clay	H - High Plasticity
Pt - Peat	O - Organic

Explanation of Common Terms Used in Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT*	S_u** (tsf)	Term	SPT*	Term
Easily penetrated several inches by fist.	0 - 2	< 0.125	Very Soft	0 - 4	Very Loose
Easily penetrated several inches by thumb.	2 - 4	0.125 - 0.25	Soft	4 - 10	Loose
Can be penetrated several inches by thumb with moderate effort.	4 - 8	0.25 - 0.50	Medium Stiff	10 - 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	8 - 15	0.50 - 1.0	Stiff	30 - 50	Dense
Readily indented by thumbnail.	15 - 30	1.0 - 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	> 30	> 2.0	Hard		

* SPT N-value in blows per foot (bpf)
** Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldable.
Moist	Grains appear darkened, but no visible water. Silt/clay will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grain surfaces. Sand and cohesionless silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Non-plastic	0 - 3	Cannot be rolled into a thread at any moisture.
Low Plasticity	3 - 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 - 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and re-rolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least ¼ inch thick.
Laminated	Alternating layers less than ¼ inch thick.
Fissured	Contains shears and partings along planes of weakness.
Slickensided	Partings appear glossy or striated.
Blocky	Breaks into small lumps that resist further breakdown.
Lensed	Contains pockets of different soils.

Term	Soil Cementation Criteria
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
Surface: Bare earth							SILT, trace to some sand (ML); brown to light brown, non-plastic, damp, stiff, fine sand, (loess).
	1	S-1-1					
	2						
	3	S-1-2					Dry to damp below ±3 feet.
	4						
No seepage or groundwater encountered to the limit of the exploration.	5						
	6	S-1-3					Very stiff to hard with moderate cementation below ±6 feet.
Kubota KX91-3 mini excavator encountered practical digging refusal at ±6.5 feet.	7				6.5		BOTTOM OF EXPLORATION

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Test Pit Log: TP-1
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
Surface: Bare earth							SILT, some sand (ML); light brown, non-plastic, damp, very stiff with weak cementation, fine sand, (loess).
	1	S-2-1					
	2						
	3						
	4						
No seepage or groundwater encountered to the limit of the exploration.	5	S-2-2					Hard with moderate to strong cementation below ±5 feet.
Kubota KX91-3 mini excavator encountered practical digging refusal at ±5.5 feet.	6				5.5		BOTTOM OF EXPLORATION
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Test Pit Log: TP-2
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
Surface: short grass Fine roots extend to ±5 inches.	1 2 3 4 5 6 7 8	S-3-1 S-3-2 S-3-3			4.0 8.0		SILT, some sand (ML); brown, non-plastic, damp to moist, soft to medium stiff, fine sand, (loess). SILT, trace to some sand (ML); brown to light brown, low plasticity to non-plastic, damp, stiff with zones of weak cementation, fine sand, (loess). BOTTOM OF EXPLORATION

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Test Pit Log: TP-3
Eastern Oregon Regional Airport - Pendleton
SRE and Maintenance Hangars
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
Surface: short grass Fine roots extend to ±4 inches.	1 2 3 4 5 6 7	S-4-1 S-4-2 S-4-3			4.0 7.0		SILT, trace sand (ML); brown, low plasticity to non-plastic, damp, medium stiff, fine sand, (loess). SILT, some sand (ML); brown to light brown, low plasticity to non-plastic, dry to damp, stiff to very stiff with weak cementation, fine sand, (loess). BOTTOM OF EXPLORATION

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Test Pit Log: TP-4
Eastern Oregon Regional Airport - Pendleton
SRE and Maintenance Hangars
Pendleton, Oregon

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 — 50 — 100)	Backfill/ Installations/ Water Table
	SILT, trace to some sand (ML); brown, non-plastic, damp to moist, soft to medium stiff, fine sand (loess).		0.0			Backfilled with soil cutting and bentonite chips
1						
2						
3				SS-1-1	4	
4	Stiff below ±4 feet.					
5				SS-1-2	11	
6						
7						
8				SS-1-3	50/1st 5"	
	Hard with moderate to strong cementation below ±8 feet.					
9	BOTTOM OF BORING		9.0			

Project No.: 2211022

Surface Elevation: N/A

Date of Boring: March 9, 2021

Foundation Engineering, Inc.

Boring Log: BH-1

Eastern Oregon Regional Airport - Pendleton

SRE and Maintenance Hangars

Pendleton, Oregon

Last edited AJC (3/25/2021)

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
		C-1-1			0.2		ASPHALTIC CONCRETE (±2 inches).
	1	C-1-2			0.8		CRUSHED ROCK, some silt (GP-GM) (±7 inches); grey, non-plastic silt, damp, dense, ±3/4-inch minus angular rock, (base rock).
	2						SILT, trace to some sand (ML); brown, non-plastic, medium stiff, fine sand, (loess).
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 1
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
		C-2-1			0.2		ASPHALTIC CONCRETE (±2.25 inches).
	1	C-2-2			0.8		Silty sandy CRUSHED ROCK (SM to GM) (±8.75 inches); grey, non-plastic silt, damp, dense, ±3/4-inch minus angular rock, (base rock).
	2						SILT, trace to some sand (ML); brown, non-plastic, medium stiff, fine sand, (loess).
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 2
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
		C-3-1			0.2		ASPHALTIC CONCRETE (±2.5 inches).
	1	C-3-2					CRUSHED ROCK (GP) (±8.5 inches); grey, damp, very dense, ±3/4-inch minus angular rock, (base rock).
					0.9		SILT, trace sand (ML); brown, non-plastic, damp, medium stiff, fine sand, (loess).
	2						
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 3
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
		C-4-1			0.3		ASPHALTIC CONCRETE (±3 inches).
	1	C-4-2					Silty sandy CRUSHED ROCK (GM) (±16 inches); grey-brown, non-plastic silt, damp, medium dense, ±3/4-inch minus angular rock, (base rock).
					1.6		SILT, trace to some sand (ML); brown, non-plastic, damp, stiff, fine sand, (loess).
	2						
	3						
	4						
		C-4-3					
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 4
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
							ASPHALTIC CONCRETE (±2.5 inches).
		C-5-1			0.2		CRUSHED ROCK (GP) (±6.5 inches); grey, damp, very dense, 1½-inch minus angular rock, (base rock).
	1				0.8		Silty GRAVEL, some sand (GM) (±13 inches); grey to brown, non-plastic silt, damp, dene, fine to coarse sand, fine to coarse subangular to angular gravel, (subbase/fill).
		C-5-2			1.8		SILT, trace to some sand (ML); brown, non-plastic, damp, stiff, fine sand, (loess).
	2						
	3						
	4						
		C-5-3					
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 5
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
							ASPHALTIC CONCRETE (±6.5 inches).
		C-6-1			0.5		CRUSHED GRAVEL (GW) (±8 inches); grey, damp, very dense, ±1½-inche minus angular to subrounded gravel, (base rock).
	1				1.2		SILT, trace to some sand (ML); brown, non-plastic, damp, medium stiff, fine sand, (loess).
		C-6-2					
	2						
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 6
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
							ASPHALTIC CONCRETE (±4.5 inches).
		C-7-1			0.4		CRUSHED GRAVEL (GW) (±8.5 inches); grey, damp, dense, ±1½-inch minus angular to subrounded gravel, (base rock).
	1	C-7-2			1.1		SILT, some sand (ML); brown, non-plastic, damp, medium stiff, fine sand, (loess).
	2						
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 7
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
		C-8-1			0.2		ASPHALTIC CONCRETE (±2 inches).
					0.8		CRUSHED ROCK, some silt (GP-GM) (±8 inches); grey, non-plastic silt, damp, dense, ±3/4-inch minus angular rock, (base rock).
	1	C-8-2					Sandy SILT (ML); brown, non-plastic, damp, medium stiff, fine sand, (loess).
	2						
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 8
Eastern Oregon Regional Airport - Pendleton
Taxilanes and Apron Rehabilitation
Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
	0	C-9-1			0.2		ASPHALTIC CONCRETE (±2.25 inches).
	1	C-9-2			0.8		CRUSHED ROCK, trace silt (GP) (±7.75 inches); grey, damp, dense, ±3/4-inch minus angular rock, (base rock).
	2						SILT, some sand (ML); brown, non-plastic, damp, medium stiff, fine sand, (loess).
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C- 9

Eastern Oregon Regional Airport - Pendleton

Taxilanes and Apron Rehabilitation

Pendleton, Oregon

Comments	Depth, Feet	Sample #	Location	C, TSF	Elev. Depth	Symbol	Soil and Rock Description
	0	C-10-1			0.4		ASPHALTIC CONCRETE (±4.5 inches).
	1	C-10-2			1.0		CRUSHED ROCK, trace silt (GP) (±7.5 inches); grey, damp, dense, ±3/4-inch minus angular rock, (base rock).
	2						SILT, some sand (ML); brown, non-plastic, damp, medium stiff, fine sand, (loess).
	3						
	4						
	5				5.0		BOTTOM OF EXPLORATION
	6						
	7						

Project No.: 2211022

Surface Elevation: N/A (Approx.)

Date of Test Pit: March 9, 2021

Core Hole Log: C-10

Eastern Oregon Regional Airport - Pendleton

Taxilanes and Apron Rehabilitation

Pendleton, Oregon

Table 1B. Summary of Pavement Thicknesses

[1]Exploration	Asphaltic Concrete Thickness (in.)	[2]Base Rock/Fill Thickness (in.)	[3]Total Pavement Section Thickness (in.)
C-1	2	7	9
C-2	2.25	8.75	11
C-3	2.5	8.5	11
C-4	3	16	19
C-5	2.5	19.5	22
C-6	6.5	8	14.5
C-7	4.5	8.5	13
C-8	2	8	10
C-9	2.25	7.75	10
C-10	4.5	7.5	12

Notes:
1. See Figures 2A and 3A for approximate pavement core locations.
2. Base rock and/or granular fill beneath the existing pavements varies across the project area, consisting of CRUSHED ROCK or CRUSHED GRAVEL with variable amounts of sand and silt. USCS Classifications include GP, GP-GM, GM, SM to GM, and GW.
3. Total Pavement section thickness includes AC and base rock/fill layer. See logs for additional details.

Photo 1. Pavement Core C-1

Photo 2. Pavement Core C-2

Photo 3. Pavement Core C-3

Photo 4. Pavement Core C-4

Photo 5. Pavement Core C-5 (Note: 6″ core thickness estimated based on drilling)

Photo 6. Pavement Core C-6

Photo 7. Pavement Core C-7

Photo 8. Pavement Core C-8

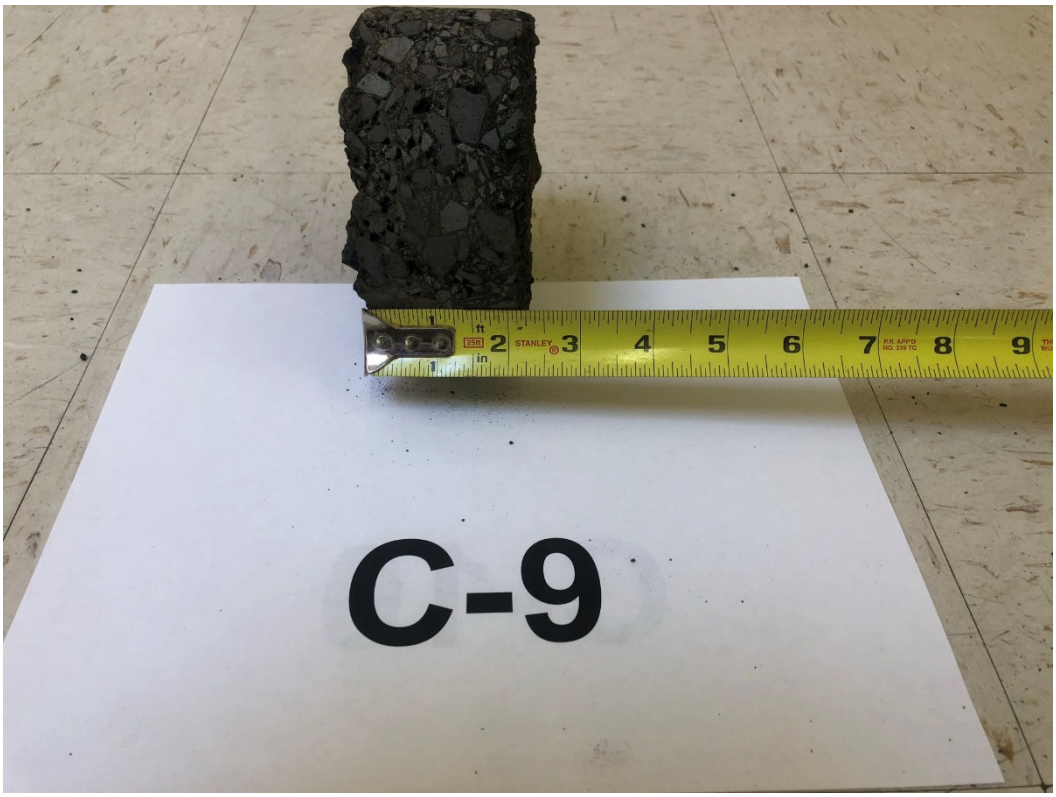


Photo 9. Pavement Core C-9

Photo 10. Pavement Core C-10

Appendix C

Field and Laboratory Test Results

Professional Geotechnical Services

Foundation Engineering, Inc.

Table 1C. Summary of DCP Test Results

Exploration	Initial Test Depth (inches)	Soil Description	[1]Average DCP (mm/blow)	[2]Average M_r (psi)	[3]Corrected M_r (psi)	[4]Correlated CBR Value
C-1	2	CRUSHED ROCK, some silt (GP-GM) (base rock)	6.4	23,774	14,740	-
	9	SILT, trace to some sand (ML)	42.8	11,327	3,964	2.6
C-2	2.5	Silty sandy CRUSHED ROCK (SM to GM) (base rock)	6.4	23,778	14,742	-
	36	SILT, trace sand (ML)	57.7	10,082	3,529	2.4
C-3	2.5	CRUSHED ROCK (GP) (base rock)	3.7	29,288	18,159	-
	13	SILT, trace sand (ML)	31.0	12,844	4,495	3.0
C-4	3	Silty sandy CRUSHED ROCK (GM) (base rock)	27.5	13,452	8,340	-
	24	SILT, trace to some sand (ML)	57.9	10,066	3,523	2.3
C-5	2.5	CRUSHED ROCK (GP) (base rock)	2.7	33,519	20,782	-
	15	SILT, trace to some sand (ML)	18.7	15,654	5,479	3.7
C-6	6.5	CRUSHED GRAVEL (GW) (base rock)	2.8	32,916	20,408	-
	15	SILT, trace to some sand (ML)	25.6	13,838	4,843	3.2
C-7	4.5	CRUSHED GRAVEL (GW) (base rock)	4.8	26,536	16,452	-
	15	SILT, some sand (ML)	26.2	13,717	4,801	3.2
C-8	2	CRUSHED ROCK, some silt (GP-GM) (base rock)	6.4	23,712	14,701	-
	11	Sandy SILT (ML)	6.8	23,152	8,103	5.4
C-9	2.5	CRUSHED ROCK, trace silt (GP) (base rock)	5.9	24,481	15,178	-
	11	SILT, some sand (ML)	15.0	17,034	5,962	4.0
C-10	4.5	CRUSHED ROCK, trace silt (GP) (base rock)	4.8	26,608	16,497	-
	12	SILT, some sand (ML)	24.6	14,056	4,920	3.3

Notes:
1. DCP (mm/blow) based on the average readings from the initial test depth.
2. M_r value based on average DCP value at the test depth and the ODOT recommended correlation: $M_r = 49{,}023\ (DCP)^{-0.39}$. Values may vary slightly due to rounding.
3. Corrected M_r value is based on the ODOT recommended correction factor of 0.35 for subgrade and 0.62 for base rock.
4. Correlated CBR value for subgrade is based on the FAA recommended correlation of $M_R = 1{,}500 * CBR$.

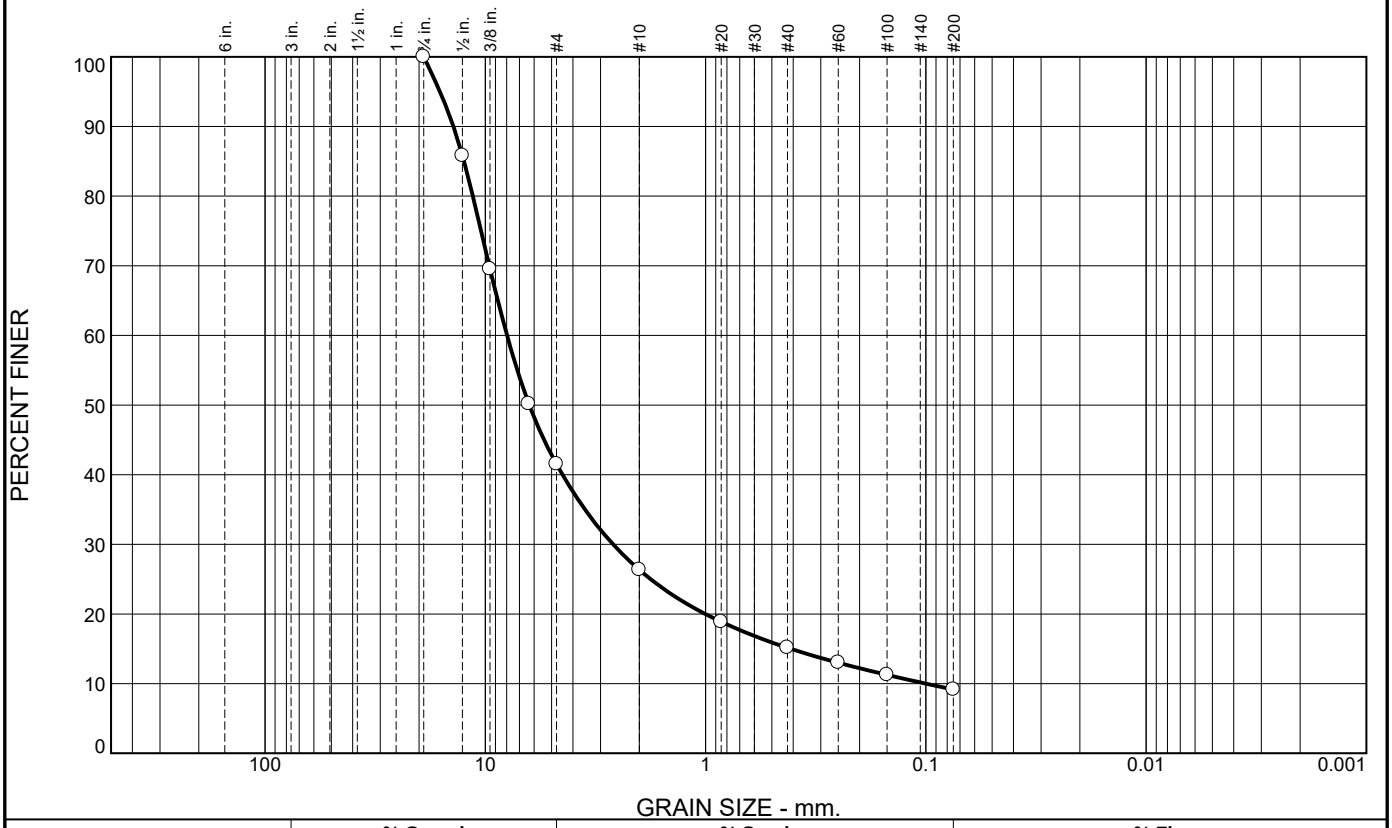
Table 2C. Moisture Content, Atterberg Limits and Percent Fines

Sample Number	Sample Depth (feet)	Moisture Content (%)	LL	PL	[1]PI	[2]Fines (%)	FAA/USCS Classification
S-1-1	1.0 – 2.0	16.4				86	ML
S-2-1	1.0 – 2.0	13.1				71.6	ML
S-3-1	1.0 – 2.0	23.0			NP	81.2	ML
S-4-1	1.0 – 2.0	20.3				88.7	ML
SS-1-1	2.5 – 4.0	21.4					
SS-1-2	5.0 – 6.5	21.7				77.3	ML
C-1-1	0.2 – 0.4					9.2	GP-GM
C-1-2	0.8 – 2.5	24.8					
C-2-1	0.2 – 0.4					19	SM to GM
C-2-2	0.9 – 2.5	23.9				86.5	ML
C-3-2	0.9 – 2.5	23.2					
C-4-1	0.3 – 0.4					22	GM
C-4-3	4.5 - 5.0	31.4			NP		ML
C-5-3	4.5 – 5.0	20.0					
C-6-2	1.3 – 2.5	18.3					
C-7-1	0.4 – 0.7					3.8	GW
C-7-2	1.1 – 2.5	18.6				82.9	ML
C-8-1	0.2 – 0.4					8.1	GP-GM
C-8-2	0.9 – 2.5	23.5				69.1	ML
C-9-2	0.9 – 2.5	23.7					
C-10-2	1.0 – 2.5	20.0					

Note: 1. NP indicates an Atterberg limits test was attempted, but the sample was determined to be non-plastic.

2. Fines content and USCS classification for samples S-1-1, C-1-1, C-2-1, C-4-1, C-7-1, and C-8-1 were determined from gradation tests. See results provided in Figures 1C through 6C.

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	58	16	11	6	9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
1/2	86		
3/8	70		
1/4	50		
#4	42		
#10	26		
#20	19		
#40	15		
#60	13		
#100	11		
#200	9.2		

* (no specification provided)

Material Description

Grey CRUSHED ROCK, some silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.9608 D_{85}= 12.4948 D_{60}= 7.9683
D_{50}= 6.3183 D_{30}= 2.6294 D_{15}= 0.4102
D_{10}= 0.0997 C_u= 79.93 C_c= 8.70

Classification

USCS= GP-GM AASHTO=

Remarks

Sample obtained from Core Hole C-1

Source of Sample: 8139 **Depth:** 2"-5"
Sample Number: C-1-1

Date: 03-12-2021

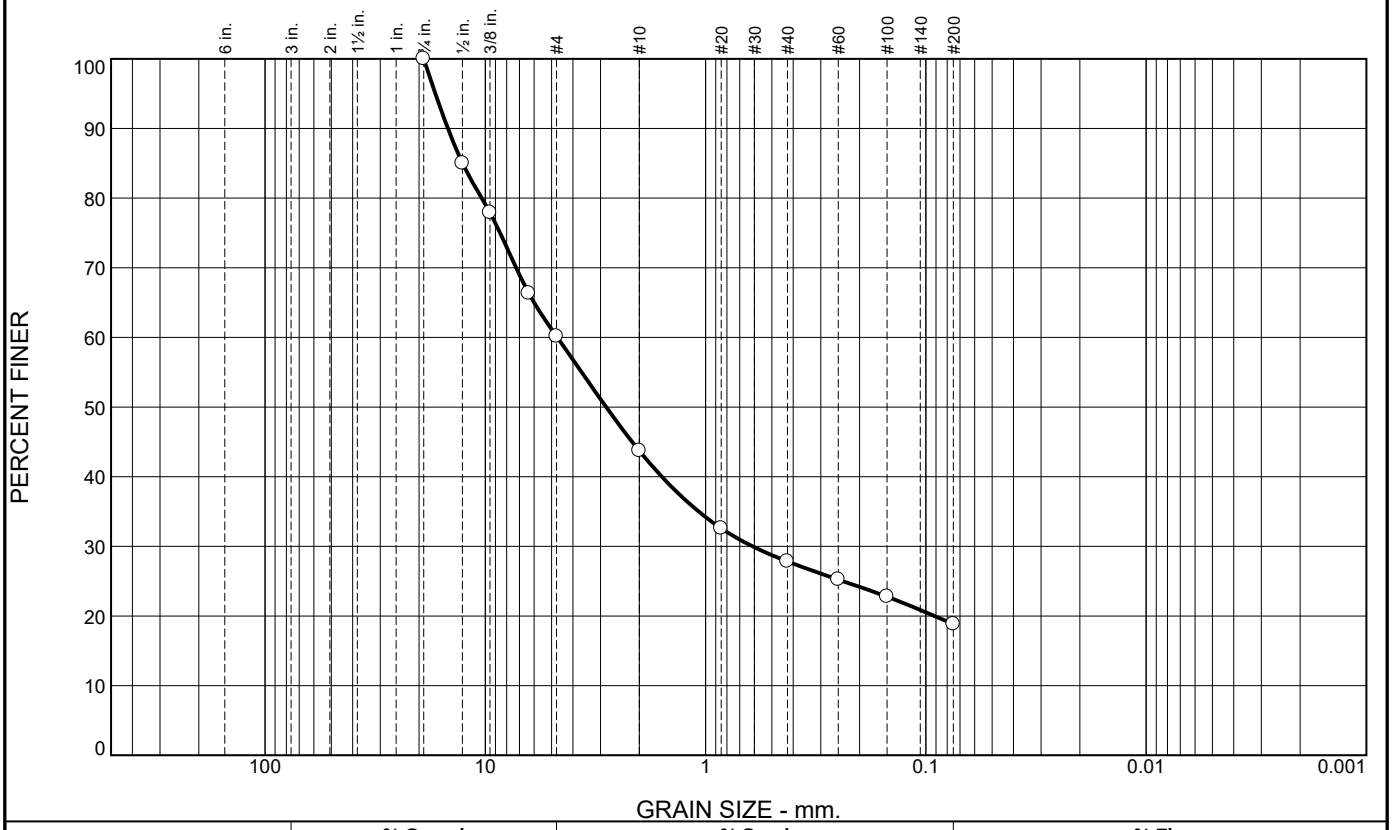
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering, Inc. (Project No. 2211022)
Project: Pendleton Airport

Project No: 2216001-602 **Figure 1C**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	40	16	16	9	19	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
1/2	85		
3/8	78		
1/4	66		
#4	60		
#10	44		
#20	33		
#40	28		
#60	25		
#100	23		
#200	19		

* (no specification provided)

Material Description

Grey-brown silty sandy CRUSHED ROCK

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.7920 D_{85}= 12.6949 D_{60}= 4.7102
D_{50}= 2.8265 D_{30}= 0.6114 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM to GM AASHTO=

Remarks

Sample obtained from Core Hole C-2

Source of Sample: 8139 **Depth:** 2.25"-5"
Sample Number: C-2-1

Date: 03-12-2021

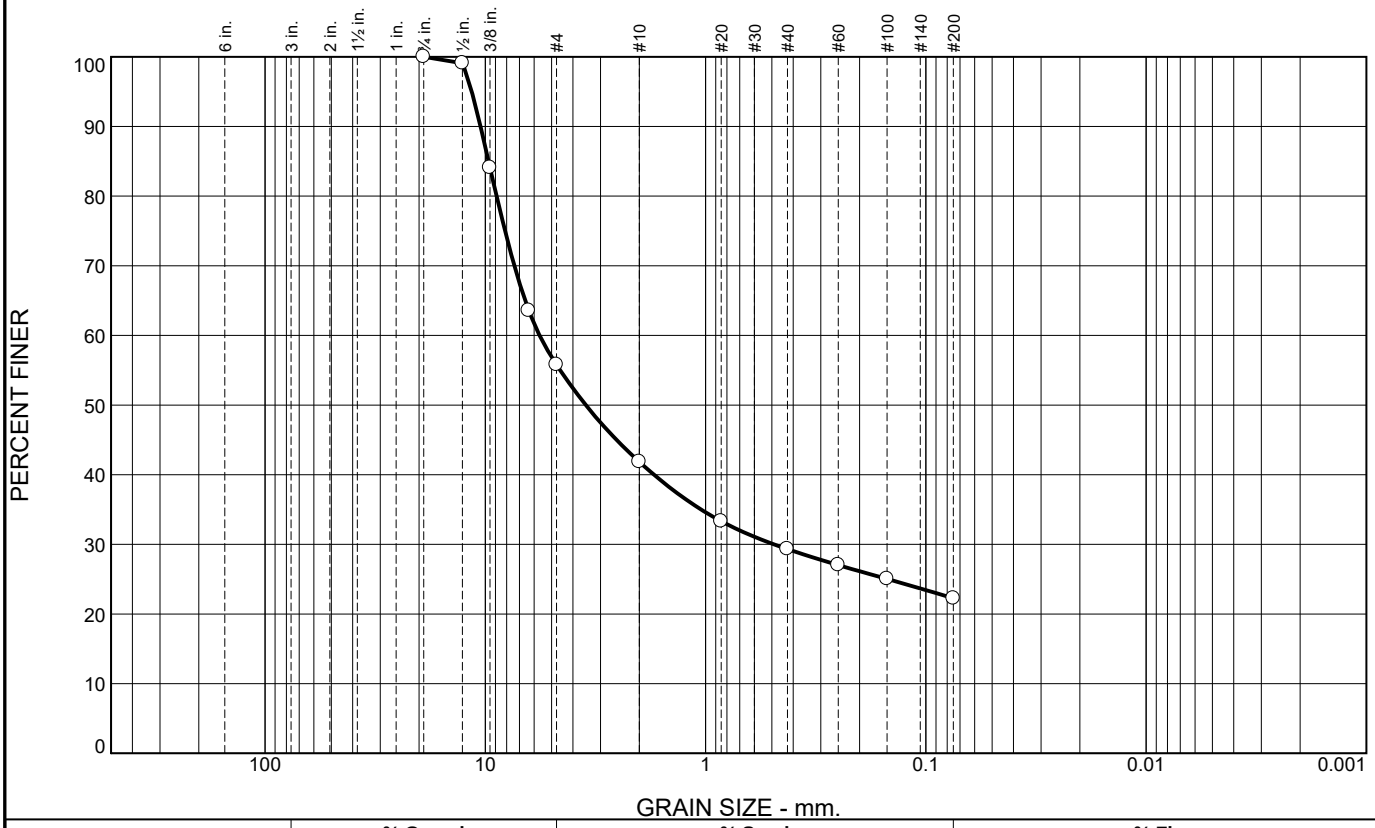
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering, Inc. (Project No. 2211022)
Project: Pendleton Airport

Project No: 2216001-602 **Figure 2C**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	44	14	13	7	22	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
1/2	99		
3/8	84		
1/4	64		
#4	56		
#10	42		
#20	33		
#40	29		
#60	27		
#100	25		
#200	22		

* (no specification provided)

Material Description

Grey-brown silty sandy CRUSHED ROCK

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.5085 D_{85}= 9.6693 D_{60}= 5.6748
D_{50}= 3.4984 D_{30}= 0.4889 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO=

Remarks

Sample obtained from Core Hole C-4

Source of Sample: 8139 **Depth:** 3"-5"
Sample Number: C-4-1

Date: 03-12-2021

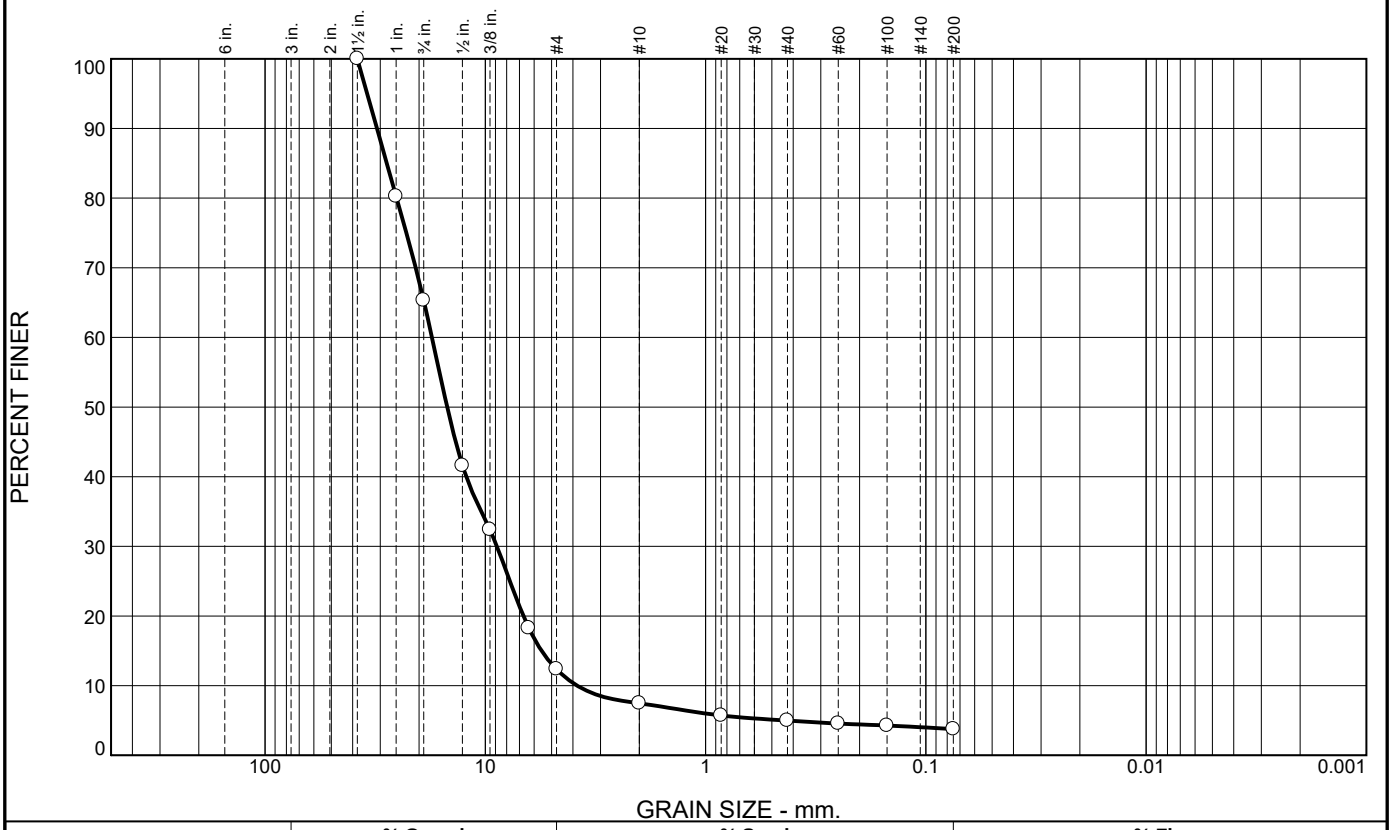
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering, Inc. (Project No. 2211022)
Project: Pendleton Airport

Project No: 2216001-602 **Figure 3C**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	35	53	5	2	1	4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2	100		
1	80		
3/4	65		
1/2	42		
3/8	32		
1/4	18		
#4	12		
#10	7		
#20	6		
#40	5		
#60	5		
#100	4		
#200	3.8		

* (no specification provided)

Material Description

Grey CRUSHED GRAVEL

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 31.0356 D_{85}= 28.0065 D_{60}= 17.4683
D_{50}= 14.8961 D_{30}= 8.8630 D_{15}= 5.5573
D_{10}= 3.8280 C_u= 4.56 C_c= 1.17

Classification

USCS= GW AASHTO=

Remarks

Sample obtained from Core Hole C- 7

Source of Sample: 8139 **Depth:** 4.5"-8"
Sample Number: C-7-1

Date: 03-12-2021

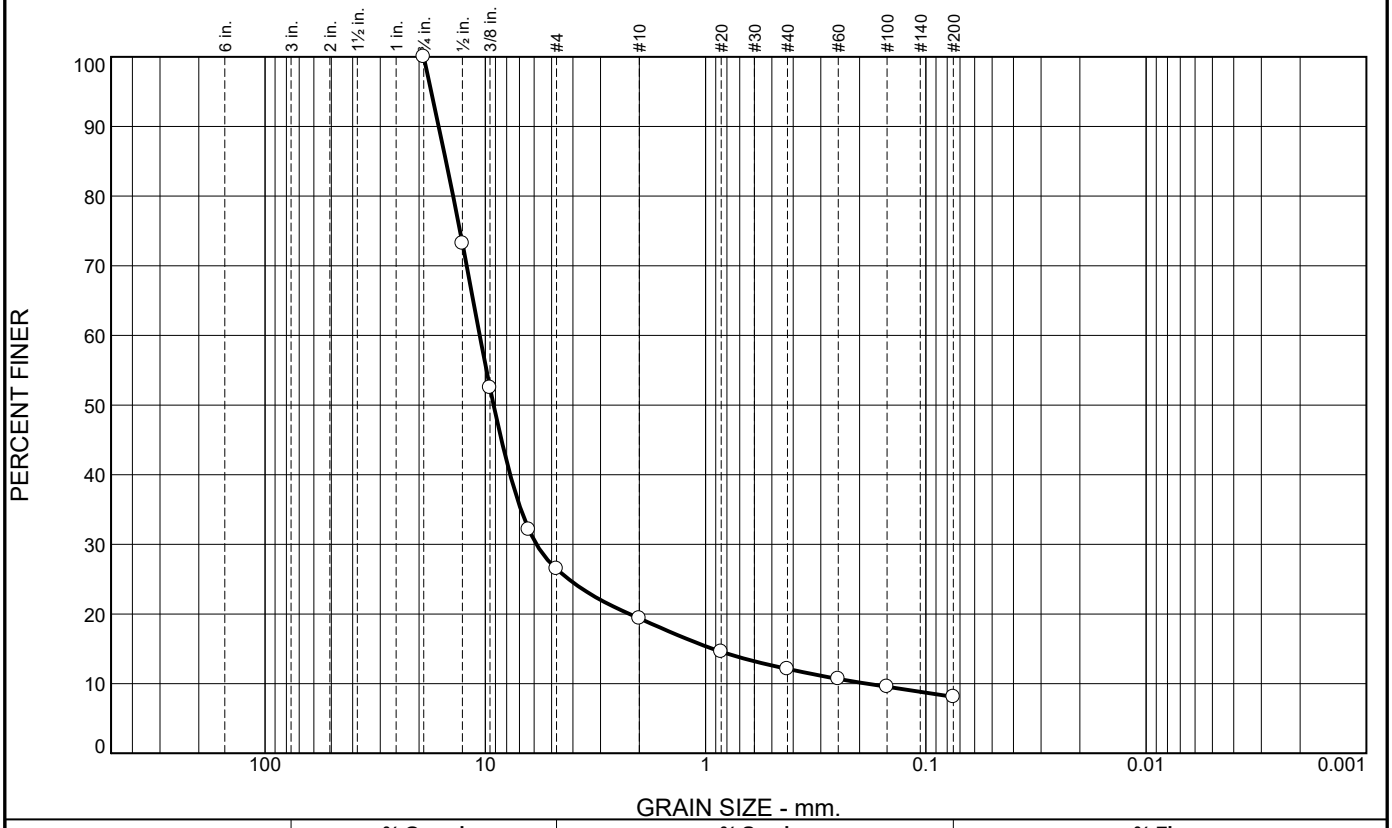
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering, Inc. (Project No. 2211022)
Project: Pendleton Airport

Project No: 2216001-602 **Figure 4C**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	74	7	7	4	8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
1/2	73		
3/8	52		
1/4	32		
#4	26		
#10	19		
#20	15		
#40	12		
#60	11		
#100	10		
#200	8.1		

* (no specification provided)

Material Description

Grey CRUSHED ROCK, some silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.2828 D_{85}= 15.0815 D_{60}= 10.5993
D_{50}= 9.1715 D_{30}= 5.8665 D_{15}= 0.9269
D_{10}= 0.1847 C_u= 57.38 C_c= 17.58

Classification

USCS= GP-GM AASHTO=

Remarks

Sample obtained from Core Hole C-8

Source of Sample: 8139 **Depth:** 2"-5"
Sample Number: C-8-1

Date: 03-12-2021

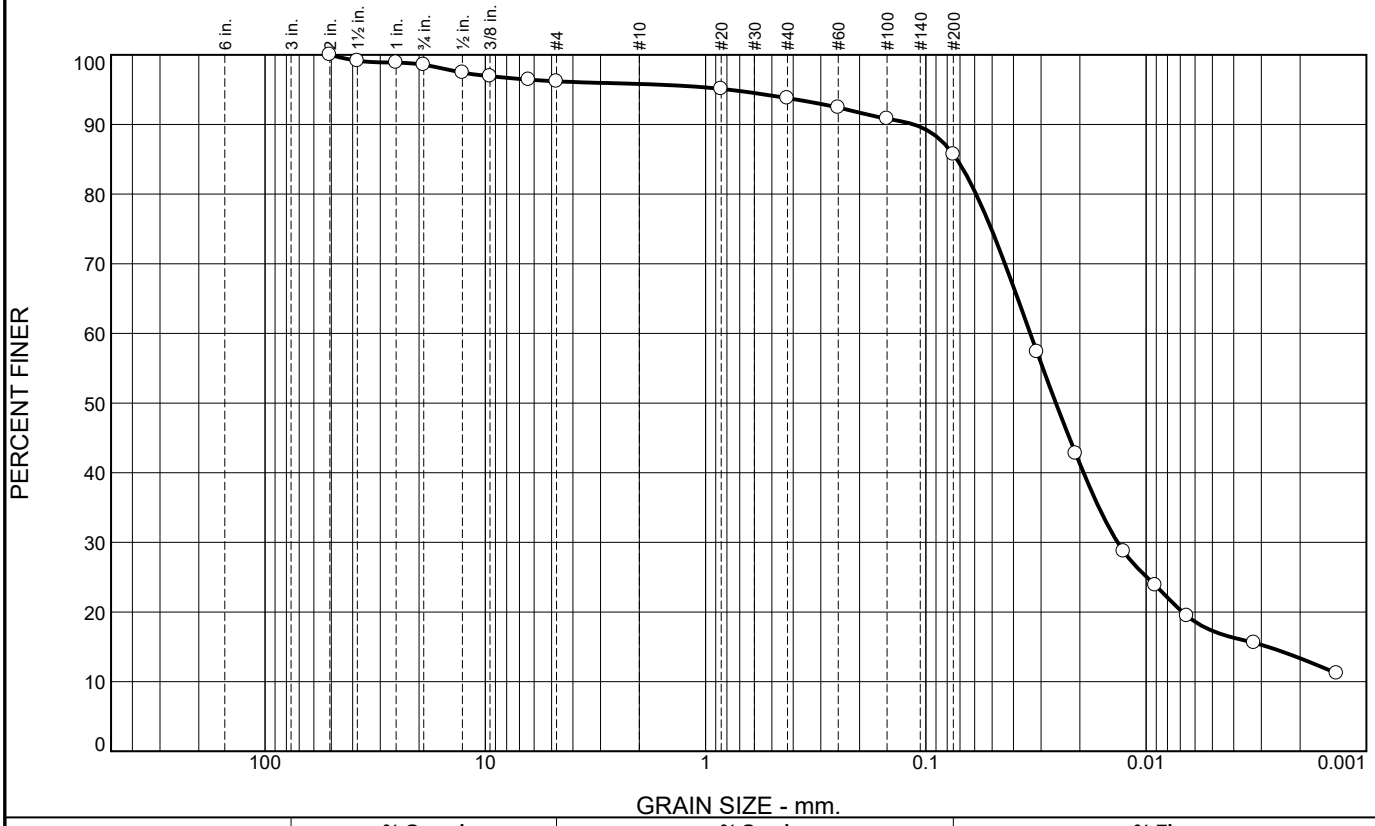
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering, Inc. (Project No. 2211022)
Project: Pendleton Airport

Project No: 2216001-602 **Figure 5C**

Sieve Analysis ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	1	3	0	2	8	69	17

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100		
1 1/2	99		
1	99		
3/4	99		
1/2	97		
3/8	97		
1/4	96		
#4	96		
#20	95		
#40	94		
#60	92		
#100	91		
#200	86		

* (no specification provided)

Material Description

Brown to light brown SILT, trace to some sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1136 D_{85}= 0.0723 D_{60}= 0.0336
D_{50}= 0.0257 D_{30}= 0.0135 D_{15}= 0.0028
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Sample obtained from Test Pit TP-1

Source of Sample: 8139 **Depth:** 1'-2'
Sample Number: S-1-1

Date: 03-15-2021

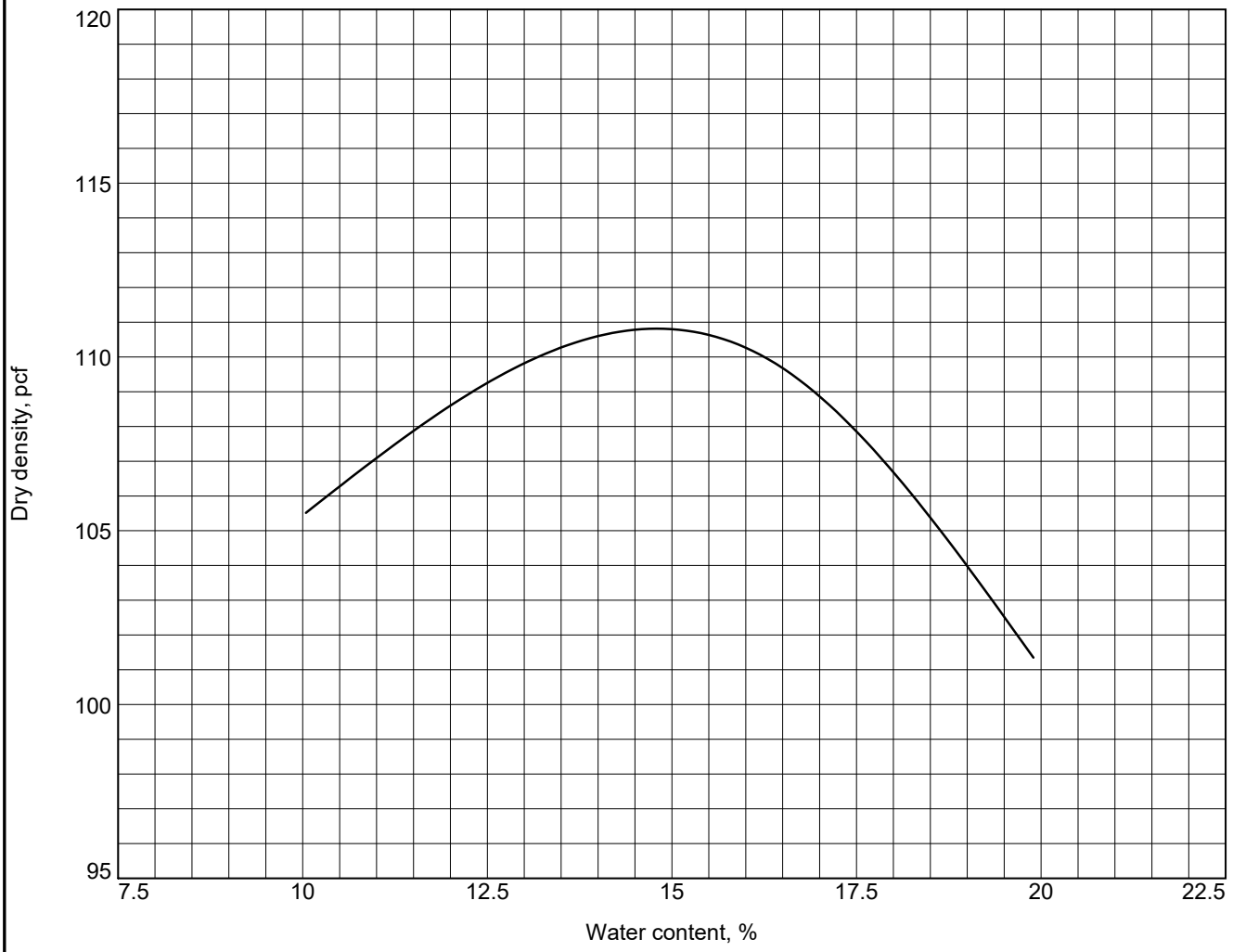
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering, Inc. (Project No. 2211022)
Project: Pendleton Airport

Project No: 2216001-602 **Figure 6C**

MOISTURE - DENSITY RELATIONSHIP CURVE



Test specification: ASTM D 1557-12 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1'-2'	ML		16.4				4	86

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.8 pcf Optimum moisture = 14.8 %	Brown to light brown SILT, trace to some sand

Project No. 2216001-602 **Client:** Foundation Engineering, Inc. (Project No. 2211022)
Project: Pendleton Airport

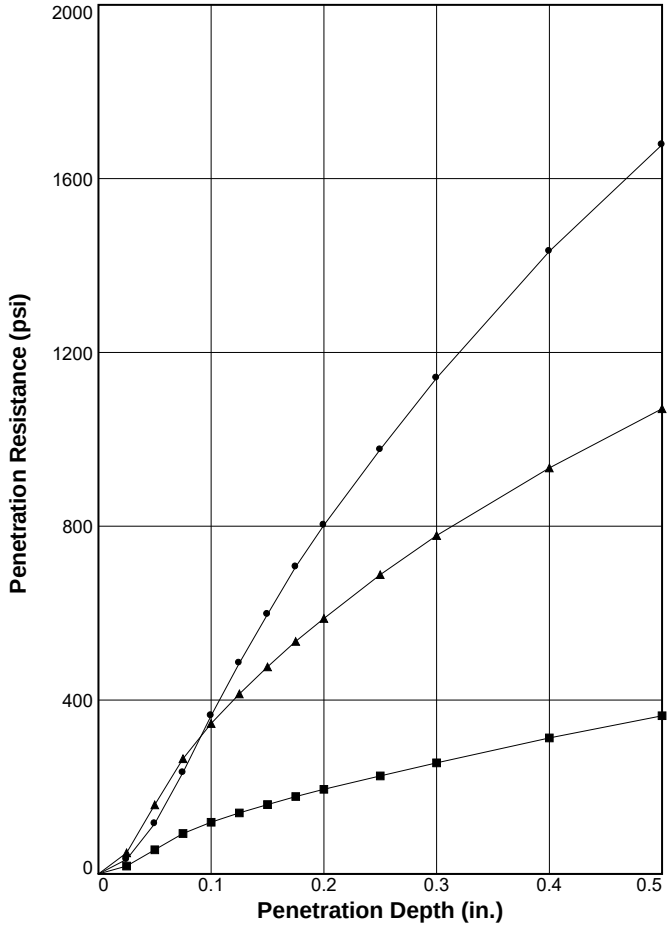
○**Source of Sample:** 8139 **Sample Number:** S-1-1

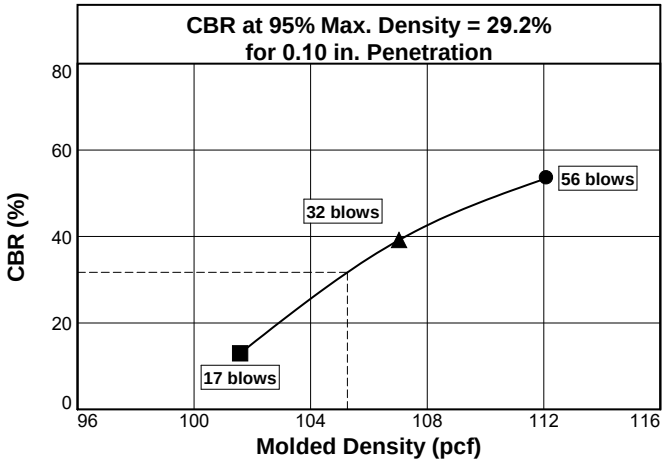
Remarks:
Sample obtained from Test Pit TP-1

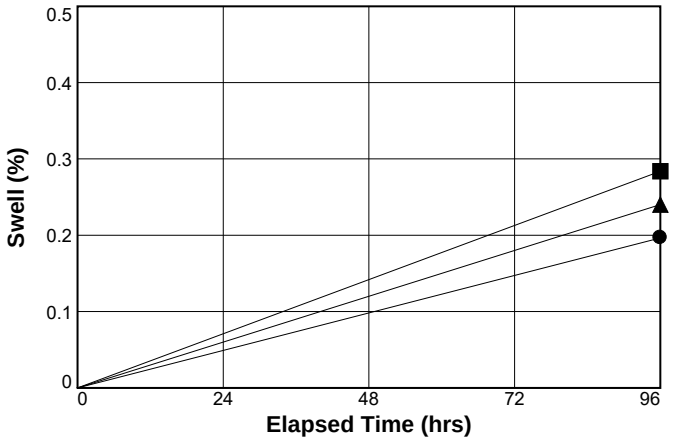
FEI Testing & Inspection, Inc.
Corvallis, OR

Figure 7C

BEARING RATIO TEST REPORT
ASTM D1883-05







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	112.1	101.2	15.2	111.9	101	18.6	36.4	53.5	0.000	32	0.2
2 △	107.0	96.6	15.1	106.8	96.4	19.0	34.6	39.2	0.000	32	0.2
3 □	101.6	91.7	15.2	101.3	91.4	21.4	11.9	13.0	0.000	32	0.3

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Brown to light brown SILT, trace to some sand	ML	110.8	14.8		

Project No: 2216001-602

Project: Pendleton Airport

Source of Sample: 8139 **Depth:** 1'-2'

Sample Number: S-1-1

Date: 03-15-2021

BEARING RATIO TEST REPORT
FEI Testing & Inspection, Inc.
Corvallis, OR

Test Description/Remarks:

Sample obtained from Test Pit TP-1

Figure 8C

Table 3C. Summary of Moisture-Density and CBR Test Results Current and Previous Pendleton Airport Projects

Project	Sample Number	[1]Maximum Dry Density (pcf)	[1]Optimum Moisture Content (%)	LL	PI	Fines (%)	USCS	[2]CBR Value
Taxilanes and Apron Rehabilitation (2021)	S-1-1	110.8	14.8			86	ML	29.2
UAS Facility (2021)	S-5-1	102.2	19.4	-	[3]NP	77	ML	23.3
Runway 7-25 Rehabilitation (2017)	S-1-1	109.7	16.0	-	[3]NP	87.2	ML	18.3
	S-2-1	106.2	16.7	-	[3]NP	91.4	ML	15.4

Notes:
1. Maximum dry density and optimum moisture content are based on the results of ASTM D1557.
2. CBR values are based on samples compacted to 95% relative compaction based on the results of the moisture density tests.
3. NP indicates the test sample is non-plastic.

SECTION VIII

DRAWINGS