



# CONTRACT DOCUMENTS AND SPECIFICATIONS FOR AIRPORT IMPROVEMENT PROJECT

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For Mesquite Metro Airport

Mesquite, Texas

TxDOT Solicitation No.: NTB-2618MSQTE-00030

TxDOT CSJ/Project No.: 2618MSQTE

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# **NOTICE TO BIDDERS**

**NOTICE TO BIDDERS**  
**Mesquite Metro Airport**  
**TxDOT Solicitation No.: NTB-2618MSQTE-00030**

Sealed bids for the construction of airport improvements at Mesquite Metro Airport need to be addressed and delivered to Sheri Quinlan, TxDOT Aviation Division, 6230 E. Stassney Lane, 2<sup>nd</sup> Floor, Austin, Texas 78744. The delivered package must be clearly marked as “Bid Proposal”. Bids will be received until 1:00 PM May 28, 2026, then publicly opened and read. Any bid received after closing time will be returned unopened.

In general, the Aviation Construction work consists of: Taxi Lane Reconstruction/Widening and Apron Construction.

Engineers’ Estimate of Probable Cost for this project is as follows:

Base Bid Schedule 1: \$1,628,391.75

Base Bid Schedule 2: \$654,490.69

Base Bid Schedule 3: \$706,712.25

Additive Alternate 1: \$271,878.75

Additive Alternate 2: \$76,306.50

Bidding documents may be examined at: KSA Engineers, 8866 Synergy Drive, McKinney, TX 75070.

Bidders may view and obtain plan sets, free of charge, from Plans Online at the following link <https://www.dot.state.tx.us/business/plansonline/ftpinfo.htm> on the TxDOT website. **Bidders are responsible for checking this website regularly for any changes to the bid documents, such as Addendums. TxDOT can only guarantee the accuracy of information on its Aviation Projects website located at <http://www.txdot.gov/inside-txdot/division/aviation/projects.html>.**

**If another agency or construction data website references this project, please also refer to the TxDOT Aviation website mentioned above to verify the accuracy and completeness of the data.**

TxDOT Aviation uses the eGrants electronic grant management system for projects beginning Fiscal Year 2017. The awarded bidder will be required to electronically submit contract documents, pay request forms, change order requests, certified payroll, DBE/HUB reports and insurance certificates. Signing the Bid Form certifies that the bidder meets the eGrants minimum system requirements in the External User Manual found at <http://www.txdot.gov/government/funding/egrants-2016/aviation.html>

To be placed on the Bidders List for this project, please email your company name, mailing address, and your phone & email address to [AVNRFQ@txdot.gov](mailto:AVNRFQ@txdot.gov).

Technical questions concerning the specifications should be directed to Mr. Chad Pennel, P.E. at 972-542-2995 or email: [cpennel@ksaeng.com](mailto:cpennel@ksaeng.com). Please call Sheri Quinlan, Contract Specialist, TxDOT Aviation at 512-416-4500 for questions concerning the bid document or further information.

Minimum wage rates have been predetermined as required by law and are set forth in the specifications.

Cashier’s check, money order, or teller’s check drawn by or on a state or national bank, a savings and loan association, or a state or federally chartered credit union (collectively referred to as “bank”) in the amount of two percent (2%) of the total bid price stated in the bid, made payable without recourse to TxDOT Aviation, Agent for the Owner or a bid bond in the same amount from a reliable corporate surety authorized to do business in the State of Texas and acceptable to TxDOT Aviation, Agent for the Owner must accompany each bid as a guarantee that the bidder, if successful, will enter into a contract, and make bond in accordance with the requirements of the specifications. TxDOT Aviation reserves the right to retain any check, bank money order or bank draft as liquidated damages in the event the bidder withdraws its bid after the bids are opened and before official rejection of the bid by TxDOT Aviation/Owner, or, if successful in securing the award of the contract, the successful bidder fails to enter into the contract and fails to furnish satisfactory performance and payment bonds.

All noted documents below shall be completed and submitted to be considered a complete Bid Package. If any of the listed documents are incomplete or missing, the bid will be deemed non-responsive.

<b>Required Documents:</b>
<input type="checkbox"/> Bid Form
<input type="checkbox"/> Bid Bond (must include the Power Attorney and claim notice page)
<input type="checkbox"/> Required Language in Proposals for AIP Contracts
<input type="checkbox"/> Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
<input type="checkbox"/> Buy American Certification
<input type="checkbox"/> Certification of Non-Segregated Facilities
<input type="checkbox"/> DBE Participation Plan: The DBE Participation Plan must be submitted <u>no later than 5 calendar days from bid opening</u> . <i>When computing any period of time described in this part, the day from which the period begins to run is not counted, and when the last day of the period is a Saturday, Sunday, or Federal holiday, the period extends to the next day that is not a Saturday, Sunday, or Federal holiday. Similarly, in circumstances where the recipient's offices are closed for all or part of the last day, the period extends to the next day on which the agency is open.</i> <ol style="list-style-type: none"> <li>1) DBE Commitment Agreement Form No. SMS.4901,</li> <li>2) DBE Program Material/Supplier Form No. SMS.4901-MS and,</li> <li>3) DBE Trucking Commitment Form No. SMS.4901-T.</li> </ol> <p>Please download the appropriate DBE Commitment Agreement <u>or</u> Good faith effort form from the TxDOT website at <a href="http://www.txdot.gov/business/partnerships/dbe-forms.html">http://www.txdot.gov/business/partnerships/dbe-forms.html</a>. There are three available DBE commitment forms. You must pick the commitment form that applies to your subcontract agreement. Then you and your DBE(s) must complete the form and return it with the signed DBE plan by the required date.</p> <ol style="list-style-type: none"> <li>4) Form 4000 Contractor’s Certification Good Faith Effort <b><u>(if unable to meet specified goal)</u></b></li> </ol>

The successful bidder will be required to furnish a Performance Bond and Payment Bond with the Power of Attorney and claim page, each in the full amount of the contract price, executed by a surety company or surety companies authorized to execute surety bonds under and in accordance with the laws of the State of Texas.

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

The Agent, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award. The Disadvantage Business Enterprise (DBE) Goal is (0)%.

The proposed contract is subject to 49 CFR Part 26 concerning the participation of Disadvantaged Business Enterprises and is under and subject to Executive Order 11246 of September 24, 1965, and to the Equal Opportunity Clause contained in the bidding documents.

The proposed contract is subject to the Aviation Safety and Capacity Expansion Act of 1990.

A Pre-Bid conference concerning this project will be held at 11:00 PM on May 13, 2026, Mesquite Metro Airport, Airport Terminal, 1340 Airport Blvd., Mesquite, Texas 75181.

The City of Mesquite

**REQUIRED LANGUAGE  
IN PUBLISHED  
ADVERTISEMENT FOR  
AIP CONSTRUCTION  
CONTRACTS**

## **REQUIRED LANGUAGE IN PUBLISHED ADVERTISEMENT FOR BIDS FOR AIP CONSTRUCTION CONTRACTS**

### **A. Required Language In Published Advertisements For Bids All AIP Contracts:**

(1) Policy. It is the policy of the Department of Transportation (DOT) that disadvantaged business enterprises as defined in 49 CFR Part 26 shall have the maximum opportunity to participate in the performance of contracts financed in whole or in part with Federal funds.

(2) Buy American Provision.

The proposed contract is subject to the Buy American provision under Section 9129 of the Aviation Safety and Capacity Expansion Act of 1990. Details of such requirement are contained in the Specifications.

### **B. Additional Language Required in Published Advertisement For Bids For AIP Contract Where The Sponsor Has A DBE Program In Effect Or Is Required By 49 CFR Part 26 To Have An Approved DBE Program.**

All bidders and proposers shall make good faith efforts as defined in Appendix A of 49 CFR Part 26, Regulations of the Office of the Secretary of Transportation, to subcontract 0% of the dollar value of the prime contract to small business concerns owned and controlled by socially and economically disadvantage include women, Blacks, Hispanics, Native Americans, Asian-Pacific Americans and Asian Indian Americans. The apparent successful bidder (proposer) will be required to submit information concerning the DBEs that will participate in this contract. The information will include the name and address for each DBE, a description of the work to be performed by each named firm, and the dollar value of the contract (subcontract). If the bidder fails to achieve the contract goal as stated herein, it will be required to provide documentation demonstrating that it made good faith efforts in attempting to do so. A bid that fails to meet these requirements will be considered non-responsive.

### **C. Required Notes for Contract over \$10,000.**

The regulations and orders of the Secretary of Labor, OFCCP and FAR 152.61 require the contractor(s) include, in invitations for bids or negotiations for contract over \$10,000, the following notices:

- (1) The proposed contract is under and subject to Executive Order 11246 of September 24, 1965, and to the Equal Opportunity Clause. The Bidder's (Proposer's) attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth in the Specifications.
- (2) The Bidder (Proposer) must supply all the information required by the bid or proposal form.

- (3) The successful bidder will be required to submit a Certification of Non-segregated Facilities prior to award of the contract, and to notify prospective subcontractors of the requirement for such a Certification where the amount of the subcontract exceeds \$10,000. Samples of the Certifications and Notice to Subcontractors appear in the Specifications.
- (4) Women will be afforded equal opportunity in all areas of employment. However, the employment of women shall not diminish the standards or requirements for the employment of minorities.

D. **Contract in Excess of \$50,000.**

For contracts of \$50,000 or more, a contractor having 50 or more employees, and his subcontractors having 50 or more employees and who may be awarded a subcontract of \$50,000 or more, will be required to maintain an affirmative action program within 120 days of the commencement of the contract.

E. **Additional Notices for \$1 Million Contracts.**

- (1) Pre-award Equal Opportunity Compliance Reviews. Where the bid of the apparent low responsible bidder is in the amount of \$1 million or more, the bidder and his known all-tier subcontractors which will be awarded subcontracts of \$1 million or more will be subject to full on-site, pre-award equal opportunity compliance reviews before the award of the contract for the purpose of determining whether the bidder and his subcontractor are able to comply with the provisions of the equal opportunity clause.
- (2) Compliance Reports. Within 30 days after award of this contract, the contractor shall file a compliance report (Standard Form 100) if:
  - (a) The contractor has not submitted a complete compliance report within 12 months preceding the date of award; and
  - (b) The contractor is within the definition of "employer" in Paragraphs 2e(3) of the instructions included in Standard Form 100.
- (3) The contractor shall require the subcontractor on all-tier subcontracts, irrespective of dollar amount, to file Standard Form 100 within 30 days after award of the subcontract if the above two conditions apply. Standard Form 100 will be furnished upon request.

**SPECIAL NOTICE TO  
BIDDERS**

## **SPECIAL NOTICE TO BIDDERS**

### **Buy American-Steel and Manufactured Products for Construction Contracts (Aviation Safety and Capacity Expansion Act of 1990)**

(A) The Aviation Safety and Capacity Expansion Act of 1990 provides that preference be given to steel and manufactured products produced in the United States when funds are expended pursuant to grant issued under this Airport Improvements Program. The following terms apply:

1. Steel and manufactured products. As used in this clause, steel and manufactured products include (1) steel produced in the United States or (2) a manufactured product produced in the United States, if the cost of its components mined, produced or manufactured in the United States exceed 60 percent of the cost of all its components and final assembly has taken place in the United States. Components of foreign origin of the same class or kind as the products referred to in subparagraphs (b) (1) or (2) shall be treated as domestic.
2. Components. As used in this clause, components mean those articles, materials, and supplies incorporated directly into steel and manufactured products.
3. Cost of Components. This means the cost of production of the components, exclusive of final assembly labor costs.

(B) The successful bidder will be required to assure that only domestic steel and manufactured products will be used by the Contractor, subcontractor's materialmen, and suppliers in the performance of this contract, except those

1. That the U.S. Department of Transportation has determined, under the Aviation Safety and Capacity Expansion Act of 1990, are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality;
2. That the U.S. Department of Transportation has determined, under the Aviation Safety and Capacity Expansion Act of 1990, that domestic preference would be inconsistent with the public interest; or
3. That inclusion of domestic material will increase the cost of the overall project by contract more than 25 percent.

# **BIDDER QUALIFICATIONS**

## **BIDDER QUALIFICATIONS**

### I. QUALIFICATIONS

- A. Each Bidder shall furnish the Texas Department of Transportation, Aviation Division satisfactory evidence of the Bidder's competency to perform the proposed work. Such evidence of competency shall consist of statements covering the Bidder's past experience on similar work, a list of equipment that would be available for the work, and a list of key personnel that would be available.
- B. In addition, each Bidder shall furnish the Texas Department of Transportation, Aviation Division, with satisfactory evidence of the Bidder's financial responsibility. Such evidence shall consist of a confidential statement or report of the Bidder's financial resources and liabilities as of the last calendar year or the Bidder's last fiscal year. Such statements or reports shall be prepared by a public accountant. At the time of submitting such financial statements or reports, the Bidder shall further certify whether the Bidder's financial responsibility is approximately the same as stated or reported by the public accountant. If Bidder's financial responsibility has changed, the Bidder shall qualify the public accountant's statement or report to reflect the Bidder's true financial condition at the time such qualified statement or report is submitted to the Texas Department of Transportation.
- C. If a Bidder is fully prequalified or prequalified under the bidder's questionnaire with the Texas Department of Transportation (TxDOT) and is on the TxDOT current "bidders list", such evidence of current TxDOT prequalification may be submitted as evidence of financial responsibility and competency in lieu of the above certified statements or reports. The bidders must acknowledge and sign the type of pre-qualification on the bid form. Bidders understand their limitations of prequalification both financially and for approved work experience related to airport development projects.
- D. If awarded the contract the bidder shall be required to submit a TxDOT - Certificate of Insurance form naming the Texas Department of Transportation as an additional insured and with a waiver of subrogation in favor of the Texas Department of Transportation. Insurance requirements are listed in the **Aviation Division General Construction Contract Provisions, volume dated February 2013.**

### II. SUBMISSION OF QUALIFICATIONS

- A. Each bidder shall submit the Bidder's "evidence of competency" and "evidence of financial responsibility", to the Texas Department of Transportation, Aviation Division at the date, time and location specified for opening bids. These items shall be submitted in the envelope with your bid marked with project number, location of airport, and name and business address of the bidder.
- B. Bids that do not include the qualification requirements listed above will be considered non-responsive and therefore disqualified.
- C. **BIDS SUBMITTED WITHOUT ACKNOWLEDGEMENT OR SUBMISSION OF ALL QUALIFICATIONS WILL NOT BE READ.**

# **INSTRUCTION TO BIDDERS**

## **INSTRUCTIONS TO BIDDERS**

IB-1. **The Bidder shall reference the Aviation Division General Construction Contract Provisions, volume dated February 2013, for all general contract provisions.** General Construction Contract Provisions may be obtained at TxDOT, Aviation Division, 6230 E. Stassney Ln., Second Floor, Austin, Texas 78744; Use latest version of referenced Advisory Circulars.

IB-2. The Bidder shall refer to Section 20, BID REQUIREMENTS AND CONDITIONS of the GENERAL PROVISIONS.

IB-3. The Bidder shall refer to: BIDDER QUALIFICATIONS section of the bid document and Section 20-02, PREQUALIFICATION OF BIDDERS of the GENERAL PROVISIONS.

IB-4. The Bidder must submit the completed bid on the formatted bid form furnished by TxDOT, with all blank spaces in the TxDOT bid form correctly typed in for each and every item for which a quantity is given.

The Bidder shall sign the bid in ink. If the bid is made by an individual, the individual's name and address must be shown. If made by a partnership, the name and address of each member of the partnership must be shown. If made by a corporation, the person signing the bid shall give the name of the state under the laws of which the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer.

IB-5. The Bidder shall submit completed copies of all items identified under “Bidder Qualifications”. ***Bids received without Bidder Qualifications will not be read.***

IB-6. The REQUIRED LANGUAGE IN PROPOSALS FOR AIP CONTRACTS, CERTIFICATION REGARDING DEBARMENT, CERTIFICATION REGARDING FOREIGN TRADE, BUY AMERICAN CERTIFICATION, CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY, and the CERTIFICATION OF NON-SEGREGATED FACILITIES, contained in the bid document shall be completed by the Bidder and submitted with the Bid.

IB-7. Receipt of all addenda issued shall be acknowledged by the Bidder in the space provided on the Bid Form.

IB-8. Bids may be rejected if they show any alteration of words or figures, additions not called for, conditional or uncalled for alternate bids, incomplete bids, any alteration of words or figures or changes not initialed by the person or persons signing the bid, or irregularities of any kind.

IB-9. The bid shall be accompanied by a Bid Guarantee of the character and in the amount as indicated in the bid.

IB-10. Any questions arising during the advertising period as to meaning or intent of the specifications will be answered by an addendum prepared by the Engineer. Contractor shall be responsible for obtaining addenda for each interested project at our website: <http://www.txdot.gov/inside-txdot/division/aviation/projects.html>. All addenda issued shall become a part of the contract documents.

**Bidders are responsible for checking this website regularly for any changes to the bid documents, such as Addendums.**

IB-11. The Texas Department of Transportation (TxDOT) shall accept as Disadvantaged Business Enterprises (DBEs) only those firms currently certified as such by the Texas Unified Certification Program (TUCP).

IB-12. Each bid submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the Bidder on the outside. When sent by mail, preferably registered, the sealed bid, marked as indicated above, should be enclosed in an additional envelope. Bids, which are transmitted by telephone, by telegraph or by electronic means, will not be accepted.

IB-13. No bid will be considered unless received at the place specified in the advertisement before the time specified for opening all bids. Bids received after the bid opening time shall be returned to the Bidder unopened.

IB-14. Bids will be opened and read publicly at the time and place indicated in the Notice to Bidders.

IB-15. Generally, materials incorporated into a project, such as concrete, rebar, asphalt, etc., are tax exempt. Other items not incorporated into the project such as barricades and equipment rental may be subject to sales tax. A copy of the Texas Sales and Use Tax Exemption form is available through the State Comptroller website at <https://comptroller.texas.gov/forms/01-339.pdf> This form is a self-certification process. The contractor must complete the form and retain the document in their files. A copy of the form should be sent to the seller/supplier. Bidders should contact their tax consultant or the Texas Office of the Comptroller with any questions related to the payment of sales tax.

IB-16. In accordance with 49 CFR Part 26.53 the bidder/offerer must submit an acceptable DBE plan and commitment or good faith effort no later than 5 calendar days after bid opening as a matter of responsibility. For all federally funded construction projects with a DBE goal, bidders shall use the attached DBE participation plan and appropriate commitment agreement form/s and submit these documents to TxDOT Aviation within 5 calendar days after the bid opening via email to [AVNRFQ@txdot.gov](mailto:AVNRFQ@txdot.gov).

# **BID FORM**

## **BID FORM**

To obtain a formatted Bid Form, please go to either:

**1. TxDOT Aviation Projects at:**

<http://www.dot.state.tx.us/AVN/avninfo/proposal/construct/index.htm>

Or,

**2. TxDOT Plans Online at:**

<http://www.txdot.gov/inside-txdot/division/support/plans-online.html>

- The online formatted bid form should be accessed with Internet Explorer. It will not open when using Chrome.
- The bid form is formatted and allows for online input of numeric unit prices.
- Do not handwrite numeric unit prices on this formatted bid form.
- The formatted bid form should be completed online and then printed, signed and delivered to the appropriate location for the bid opening.

### **Bid Package Responsiveness Checklist:**

The following are required in order for the bid to be responsive. Bids without the following will be deemed non-responsive.

To be included with or on Bid Form

- All blanks in the bid form filled in electronically
- Addenda acknowledged (if any) Handwritten acknowledgement of addenda, in excess of 3, is required
- Bid Form signed, original in ink
- Bid form qualifications acknowledged and signed, or prequalification letter enclosed (will be used to establish bidder responsibility)
- Qualification Acknowledgement or Qualification Statement Submitted
- 2% Bid Bond, Power of Attorney, and claim page with the correct project number
- Required Language in Proposals for AIP Contracts Form
- Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
- Buy American Certification
- Certification of Non-Segregated Facilities

☐ WITHIN 5 DAYS OF BID OPENING, SUBMIT DBE PLAN AND COMMITMENT AGREEMENTS TO AVNRFQ@txdot.gov IF APPLICABLE ON FEDERALLY FUNDED PROJECTS WITH A POSTED DBE GOAL

TxDOT may consider a bid non-responsive or disqualify a bidder after the reading of bids per General Provision 20-07 and General provision 20-13.

# **BID BOND**

## **Bid Bond**

**Bid Bond** - original equal to 2% of total bid.

A bid bond may be issued on any form acceptable to the bidder's Surety Company.

**SPECIAL INSTRUCTION TO  
BIDDERS REGARDING EEO**

## **SPECIAL INSTRUCTION TO BIDDERS REGARDING EEO**

### **Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246, as amended)**

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Goals for minority  
participation in  
each trade  
18.2%

Goals for female  
participation in  
each trade  
6.9%

These goals are applicable to all the contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor is also subject to the goals for both its federally involved and non-federally involved construction.

The contractor's compliance with the executive order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR Part 60-4.3 (a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project, for the sole purpose of meeting the contractor's goals, shall be a violation of the contract, the executive order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notifications to the Director, OFCCP, within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employee identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.
4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is City of Mesquite, County of Dallas Texas.

**REQUIRED LANGUAGE IN  
PROPOSALS FOR AIP  
CONTRACTS**

**REQUIRED LANGUAGE IN PROPOSALS FOR AIP CONTRACTS**  
**(Please complete & return in bid package)**

Section 60-1.7(b) of the Regulations of the Secretary of Labor requires each bidder or prospective prime contractor and proposed subcontractor, where appropriate, to state in the bid or at the outset of negotiations for the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and if so, whether it has filed with the Joint Reporting Committee, the Director, an agency, or the former President's Committee on Equal Employment Opportunity all reports due under the applicable filing requirements. In any case in which a bidder or prospective prime contractor or proposed subcontractor which participated in a previous contract subject to Executive Order 10925, 11114, or 11246 has not filed a report due under the applicable filing documents, no contract or subcontract shall be awarded unless such contractor submits a report covering the delinquent period or such other period specified by the FAA or the Director, OFCCP.

Bid or Proposal Form. To effectuate the foregoing requirements, the sponsor is required to include in the bid or proposal form a statement substantially as follows:

The bidder (proposer) shall complete the following statements by checking the appropriate space.

The undersigned certifies on behalf of \_\_\_\_\_, that

It has developed and has on file at each establishment affirmative action programs pursuant to 41 CFR Part 60-2 (Affirmative Action Programs).

It is not subject to the requirements to develop an affirmative action program under 41 CFR Part 60-2 (Affirmative Action Programs).

The bidder (proposer) has \_\_\_\_\_ has not \_\_\_\_\_ participated in a previous contract subject to the equal opportunity clause prescribed by Executive Order 10925, or Executive Order 11114, or Executive Order 11246.

The bidder (proposer) has \_\_\_\_\_ has not \_\_\_\_\_ submitted all compliance reports in connection with any such contract due under the applicable filing requirements; and that representations indicating submission of required compliance reports signed by proposed subcontractors will be obtained prior to award of subcontracts.

If the bidder (proposer) has participated in a previous contract subject to the equal opportunity clause and has not submitted compliance reports due to applicable filing requirements, the Bidder (Proposer) shall submit a compliance report on Standard Form 100, 'Employee Information Report EEO-1 prior to the award of contract.

Standard Form 100 is normally furnished to contractors annually, based on a mailing list currently maintained by the Joint Reporting Committee. In the event a contractor has not received the form, he may obtain it by writing to the following address:

Joint Reporting Committee  
1800 G Street  
Washington, DC 20506  
(2/92)

---

Signature of Company Official

---

Date

**CERTIFICATION REGARDING  
DEBARMENT, SUSPENSION,  
INELIGIBILITY AND  
VOLUNTARY EXCLUSION**

**Certification Regarding Debarment, Suspension,  
Ineligibility and Voluntary Exclusion  
(49 CFR PART 29 and Executive Order GA-48)**  
**(Please complete & return in bid package)**

The bidder (offeror) certifies, by submission of this proposal or acceptance of this contract, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency. It further agrees that by submitting this proposal that it will include this clause without modification in all lower tier transactions, solicitations, proposals, contracts, and subcontracts. Where the bidder/offeror/contractor or any lower tier participant is unable to certify to this statement, it shall attach an explanation to this solicitation/proposal.

**Certification Regarding Foreign Trade Restrictions  
(49 CFR PART 30 and Executive Order GA-48)**

The contractor or subcontractor, by submission of an offer and/or execution of a contract, certifies that neither it, nor its holding companies or subsidiaries, is:

- a. is not owned or controlled by one or more citizens or nationals of a foreign country included in the list of countries that discriminate against U.S. firms published by the Office of the United States Trade representative (USTR);
- b. has not knowingly entered into any contract or subcontract for this project with a contractor that is a citizen or national of a foreign country on said list or is owned or controlled directly or indirectly by one or more citizens or nationals of a foreign country on said list.
- c. has not procured any product nor subcontracted for the supply of any product for use on the project that is produced in a foreign country on said list.

By signing and dating this form Bidder is certifying that the responding Company, or any of its holding companies or subsidiaries, is not:

- a. Listed in Section 889 of the 2019 National Defense Authorization Act;
- b. Listed in Section 1260H of the 2021 National Defense Authorization Act; or
- c. Owned by the government of a country on the U.S. Department of Commerce's foreign adversaries list under 15 C.F.R Section 791.4; or
- d. Controlled by any governing or regulatory body located in a country on the U.S. Department of Commerce's foreign adversaries list under 15 C.F.R Section 791.4

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to a contractor or subcontractor who is unable to certify to the above. If the contractor knowingly procures or subcontracts for the supply of any product or service of a foreign country on said list for use on the project, the Federal Aviation Administration may direct, through the sponsor, cancellation of the contract at no cost to the Government.

Further, the contractor agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in each contract and in all lower tier subcontracts. The contractor may rely upon the certification of a prospective subcontractor unless it has knowledge that the certification is erroneous. The contractor shall provide immediate written notice to the sponsor if the contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The subcontractor agrees to provide immediate written notice to the contractor, if at any time it learns that its certification was erroneous by reason of changed circumstances.

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

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

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

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Signature of Company Official

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Date

**BUY AMERICAN CERTIFICATION**

**Buy American Certification**  
**(Aviation Safety and Capacity Expansion Act of 1990)**  
**(Please complete & return in bid package)**

By submitting a bid/proposal under this solicitation, the contractor agrees to comply with 49 USC § 50101, which provides that Federal funds may not be obligated unless all steel and manufactured goods used in AIP-funded projects are produced in the United States, unless the FAA has issued a waiver for the product; the product is listed as an Excepted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list. Except for those items listed by the offeror below or on a separate and clearly identified attachment to this bid/proposal, the offeror certifies that steel and each manufactured product, is produced in the United States (as defined in the clause Buy American - Steel and Manufactured Products for Construction Contracts) and that components of unknown origin are considered to have been produced or manufactured outside the United States.

We certify that we comply with this provision and don't have any exceptions to list.

-OR-

We certify that we comply with this provision except for the products listed below.

PRODUCT

COUNTRY OF ORIGIN


\_\_\_\_\_  
Signature of Company Official

\_\_\_\_\_  
Date

**CERTIFICATION OF  
NON-SEGREGATED  
FACILITIES**

**CERTIFICATION OF NON-SEGREGATED FACILITIES**

**(Please complete & return in bid package)**

**NOTICE TO PROSPECTIVE FEDERALLY ASSISTED  
CONSTRUCTION CONTRACTORS  
(41 CFR 60-1.8)**

- (1) A Certification of Non-Segregated Facilities must be submitted prior to the award of a federally assisted construction contract exceeding \$10,000 which is not exempt from the provisions of the equal opportunity clause.
- (2) Contractors receiving federally assisted construction contract awards exceeding \$10,000 which are not exempt from the provisions of the equal opportunity clause will be required to provide for the forwarding of the following notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed \$10,000 and are not exempt from the provisions of the equal opportunity clause.

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR  
CERTIFICATION OF NON-SEGREGATED FACILITIES**

- (1) A Certification of Non-Segregated Facilities must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the equal opportunity clause.
- (2) Contractors receiving subcontract awards exceeding \$10,000 which are not exempt from the provisions of the equal opportunity clause will be required to provide for the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed \$10,000 and are not exempt from the provisions of the equal opportunity clause.

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

\_\_\_\_\_  
Signature of Company Official

\_\_\_\_\_  
Date

**DISADVANTAGED  
BUSINESS ENTERPRISE**

# **Disadvantaged Business Enterprise** **in Federal-Aid Contracts**



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## **1. DESCRIPTION**

The purpose of this Special Provision is to carry out the U.S. Department of Transportation's (DOT) policy of ensuring nondiscrimination in the award and administration of DOT-assisted Contracts and creating a level playing field on which firms owned and controlled by individuals who are determined to be socially and economically disadvantaged can compete fairly for DOT-assisted Contracts.

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## **2. DISADVANTAGED BUSINESS ENTERPRISE IN FEDERAL-AID CONTRACTS**

- 2.1. **Policy.** It is the policy of the DOT and the Texas Department of Transportation, Aviation Division (Department) that DBEs, as defined in 49 CFR Part 26, Subpart A, and the Department's DBE Program, will have the opportunity to participate in the performance of Contracts financed in whole or in part with federal funds. The DBE requirements of 49 CFR Part 26, and the Department's DBE Program, apply to this Contract as follows.

The Contractor will solicit DBEs through reasonable and available means, as defined in 49 CFR Part 26, Appendix A, and the Department's DBE Program, or show a good faith effort to meet the DBE goal for this Contract.

The Contractor, subrecipient, or subcontractor will not discriminate on the basis of race, color, national origin, or sex in the performance of this Contract. Carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted Contracts. Failure to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the Department deems appropriate.

The requirements of this Special Provision must be physically included in any subcontract.

By signing the Contract proposal, the Bidder is certifying that the DBE goal as stated in the proposal will be met by obtaining commitments from eligible DBEs or that the Bidder will provide acceptable evidence of good faith effort to meet the commitment.

### **2.2. Definitions.**

- 2.2.1. **Administrative Reconsideration.** A process by which the low bidder may request reconsideration when the Department determines the good faith effort (GFE) requirements have not been met.

- 2.2.2. **Commercially Useful Function (CUF).** A CUF occurs when a DBE has the responsibility for the execution of the work and carrying out such responsibilities by actually performing, managing, and supervising the work.
- 2.2.3. **Disadvantaged Business Enterprise (DBE).** A for-profit small business certified through the Texas Unified Certification Program in accordance with 49 CFR Part 26, that is at least 51% owned by one or more socially and economically disadvantaged individuals, or in the case of a publicly owned business, in which is at least 51% of the stock is owned by one or more socially and economically disadvantaged individuals, and whose management and daily business operations are controlled by one or more of the individuals who own it.
- 2.2.4. **DBE Joint Venture.** An association of a DBE firm and one or more other firms to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills, and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the Contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.
- 2.2.5. **DOT.** The U.S. Department of Transportation, including the Office of the Secretary, the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and the Federal Aviation Administration (FAA).
- 2.2.6. **Federal-Aid Contract.** Any Contract between the Department and a Contractor that is paid for in whole or in part with DOT financial assistance.
- 2.2.7. **Good Faith Effort.** All necessary and reasonable steps to achieve the contract goal which, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if not fully successful. Good faith efforts are evaluated prior to award and throughout performance of the Contract. For guidance on good faith efforts, see 49 CFR Part 26, Appendix A.
- 2.2.8. **North American Industry Classification System (NAICS).** A designation that best describes the primary business of a firm. The NAICS is described in the North American Industry Classification Manual—United States, which is available on the Internet at the U.S. Census Bureau website: <http://www.census.gov/eos/www/naics/>.
- 2.2.9. **Race-Conscious.** A measure or program that is focused specifically on assisting only DBEs, including women-owned businesses.
- 2.2.10. **Race-Neutral DBE Participation.** Any participation by a DBE through customary competitive procurement procedures.

- 2.2.11. **Texas Unified Certification Program (TUCP) Directory.** An online directory listing all DBEs currently certified by the TUCP. The Directory identifies DBE firms whose participation on a Contract may be counted toward achievement of the assigned DBE Contract goal.
- 2.3. **Contractor's Responsibilities.**
- 2.3.1. **DBE Liaison Officer.** Designate a DBE liaison officer who will administer the Contractor's DBE program and who will be responsible for maintenance of records of efforts and contacts made to subcontract with DBEs.
- 2.3.2. **Compliance Tracking System (CTS).** TxDOT Aviation uses the eGrants electronic grant management system for projects beginning Fiscal Year 2017. The awarded bidder will be required to electronically submit contract documents, pay request forms, change order requests, certified payroll, DBE/HUB reports and insurance certificates. Signing the Bid Form certifies that the bidder meets the eGrants minimum system requirements in the External User Manual found at <http://www.txdot.gov/government/funding/egrants-2016/aviation.html>.
- 2.3.3. **Apparent Low Bidder.** If the DBE documentation was not submitted with the bid, the apparent low bidder must submit a DBE plan and commitments to satisfy the DBE goal or submit good faith effort Form 2603 located at <http://www.txdot.gov/inside-txdot/forms-publications/doing-business/dbe-forms.html> and supporting documentation demonstrating why the goal could not be achieved, in whole or part, **no later than 5 calendar days after bid opening**. The means of transmittal and the risk of timely receipt of the information will be the bidder's responsibility and no extension of the 5-calendar-day timeframe will be allowed for any reason. The apparent low bidder may use the DBE forms provided in the bid document and must follow the instructions on the commitment form.
- 2.3.4. **DBE Contractor.** A DBE Contractor may receive credit toward the DBE goal for work performed by its own forces and work subcontracted to DBEs. In the event a DBE subcontracts to a non-DBE, that information must be reported monthly.
- 2.3.5. **DBE Committal.** Only those DBEs certified by the TUCP are eligible to be used for goal attainment. The Department maintains the TUCP DBE Directory. The Directory can be accessed at the following website:  
<https://txdot.txdotcms.com/FrontEnd/VendorSearchPublic.asp?TN=txdot&XID=2340>.

A DBE must be certified on the day the commitment is considered and at time of subcontract execution. It is the Contractor's responsibility to ensure firms identified for participation are approved certified DBE firms.

The Bidder is responsible to ensure that all submittals are checked for accuracy. Any and all omissions, deletions, and/or errors that may affect the end result of the commitment package are the sole liabilities of the bidder.

Commitments in excess of the goal are considered race-neutral commitments.

2.3.6. **Good Faith Effort Requirements.** A Contractor who cannot meet the Contract goal, in whole or in part, must make adequate good faith efforts to obtain DBE participation as so stated and defined in 49 CFR Part 26, Appendix A.

2.3.6.1. **Administrative Reconsideration.** If the Department determines that the apparent low bidder has failed to satisfy the good faith efforts requirement, the Department will notify the Bidder of the failure and will give the Bidder an opportunity to provide written documentation or argument concerning the issue of whether it met the goal or made adequate good faith efforts to do so.

The Bidder must request an administrative reconsideration of that determination within 3 days of the date of receipt of the notice. The request must be submitted directly to the Texas Department of Transportation, Aviation Division, 125 East 11th Street, Austin, Texas 78701-2483.

If a request for administrative reconsideration is not filed within the period specified, the determination made is final and further administrative appeal is barred.

If a reconsideration request is timely received, the reconsideration decision will be made by the DBE liaison officer or, if the DBE liaison officer took part in the original determination, the Department Division Director will appoint another employee to perform the administrative reconsideration. The employee will hold a leadership position and will report directly to the Division Director.

The meeting or written documentation must be provided or held within 7 days of the date the request was submitted.

The Department will provide to the Bidder a written decision if the Bidder did or did not make adequate good faith efforts to meet the Contract goal. The reconsideration decision is final and is not administratively appealed to DOT.

2.3.7. **Determination of DBE Participation.** The work performed by the DBE must be reasonably construed to be included in the work area and NAICS work code identified by the Contractor in the approved commitment.

Participation by a DBE on a Contract will not be counted toward DBE goals until the amount of the participation has been paid to the DBE.

Payments made to a DBE that was not on the original commitment may be counted toward the Contract goal if that DBE was certified as a DBE before the execution of the subcontract and has performed a Commercially Useful Function.

The total amount paid to the DBE for work performed with its own forces is counted toward the DBE goal. When a DBE subcontracts part of the work of its Contract to another firm, the value of the subcontracted work may be counted toward DBE goals only if the subcontractor is itself a DBE.

DBE Goal credit for the DBE subcontractors leasing of equipment or purchasing of supplies from the Contractor or its affiliates is not allowed. Project materials or supplies acquired from an affiliate of the Contractor cannot directly or indirectly (second or lower tier subcontractor) be used for DBE goal credit.

If a DBE firm is declared ineligible due to DBE decertification after the execution of the DBE's subcontract, the DBE firm may complete the work and the DBE firm's participation will be counted toward the Contract goal. If the DBE firm is decertified before the DBE firm has signed a subcontract, the Contractor is obligated to replace the ineligible DBE firm or demonstrate that it has made good faith efforts to do so.

The Contractor may count 100% of its expenditure to a DBE manufacturer. According to 49 CFR 26.55(e)(1)(i), a DBE manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the Contract and of the general character described by the specifications.

The Contractor may count only 60% of its expenditure to a DBE regular dealer. According to 49 CFR 26.55(e)(2)(i), a DBE regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles, or equipment of the general character described by the specifications and required under the Contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. A firm may be a regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business if the firm both owns and operates distribution equipment for the products. Any supplementing of regular dealers' own distribution equipment must be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis. A long-term lease with a third-party transportation company is not eligible for 60% goal credit.

With respect to materials or supplies purchased from a DBE that is neither a manufacturer nor a regular dealer, the Contractor may count the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site.

A Contractor may count toward its DBE goal a portion of the total value of the Contract amount paid to a DBE joint venture equal to the distinct, clearly defined portion of the work of the Contract performed by the DBE.

2.3.8. **Commercially Useful Function.** It is the Contractor's obligation to ensure that each DBE used on federal-assisted contracts performs a commercially useful function on the Contract.

The Department will monitor performance during the Contract to ensure each DBE is performing a CUF.

Under the terms established in 49 CFR 26.55, a DBE performs a CUF when it is responsible for execution of the work of the Contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved.

With respect to material and supplies used on the Contract, a DBE must be responsible for negotiating price, determining quality and quantity, ordering the material, installing the material, if applicable, and paying for the material itself.

With respect to trucking, the DBE trucking firm must own and operate at least one fully licensed, insured, and operational truck used on the Contract. The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the Contract. The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE that leases trucks equipped with drivers from a non-DBE is entitled to credit for the total value of transportation services provided by non-DBE leased trucks equipped with drivers not to exceed the value of transportation services on the Contract provided by DBE-owned trucks or leased trucks with DBE employee drivers. Additional participation by non-DBE owned trucks equipped with drivers receives credit only for the fee or commission it receives as a result of the lease arrangement.

A DBE does not perform a CUF when its role is limited to that of an extra participant in a transaction, Contract, or project through which funds are passed in order to obtain the appearance of DBE participation. The Department will evaluate similar transactions involving non-DBEs in order to determine whether a DBE is an extra participant.

If a DBE does not perform or exercise responsibility for at least 30% of the total cost of its Contract with its own work force, or the DBE subcontracts a greater portion of the work than would be expected on the basis of normal industry practice for the type of work involved, the Department will presume that the DBE is not performing a CUF.

If the Department determines that a DBE is not performing a CUF, no work performed by such DBE will count as eligible participation. The denial period of time may occur before or after a determination has been made by the Department.

In case of the denial of credit for non-performance of a CUF, the Contractor will be required to provide a substitute DBE to meet the Contract goal or provide an adequate good faith effort when applicable.

- 2.3.8.1. **Rebuttal of a Finding of No Commercially Useful Function.** Consistent with the provisions of 49 CFR 26.55(c)(4) & (5), before the Department makes a final finding that no CUF has been performed by a DBE, the Department will notify the DBE and provide the DBE the opportunity to provide rebuttal information.

CUF determinations are not subject to administrative appeal to DOT.

- 2.3.9. **Joint Check.** The use of joint checks between a Contractor and a DBE is allowed with Department approval. To obtain approval, the Contractor must submit a completed Form 2178, "DBE Joint Check Approval," to the Department.

The Department will closely monitor the use of joint checks to ensure that such a practice does not erode the independence of the DBE nor inhibit the DBE's ability to perform a CUF. When joint checks are utilized, DBE credit toward the Contract goal will be allowed only when the subcontractor is performing a CUF in accordance with 49 CFR 26.55(c)(1).

Long-term or open-ended joint checking arrangements may be a basis for further scrutiny and may result in the lack of participation towards the Contract goal requirement if DBE independence cannot be established.

Joint checks will not be allowed simply for the convenience of the Contractor.

If the proper procedures are not followed or the Department determines that the arrangements result in a lack of independence for the DBE involved, no credit for the DBE's participation as it relates to the material cost will be used toward the Contract goal requirement, and the Contractor will need to make up the difference elsewhere on the project.

- 2.3.10. **DBE Termination and Substitution.** No DBE named in the commitment submitted under Section 2.3.5. will be terminated for convenience, in whole or part, without the Department's approval. This includes, but is not limited to, instances in which a Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm.

Unless consent is provided, the Contractor will not be entitled to any payment for work or material unless it is performed or supplied by the listed DBE.

The Contractor, prior to submitting its request to terminate, must first give written notice to the DBE of its intent to terminate and the reason for the termination. The Contractor will copy the Department on the Notice of Intent to terminate.

The DBE has 5 calendar days to respond to the Contractor's notice and will advise the Contractor and the Department of the reasons, if any, why it objects to the proposed termination of its subcontract and why the Department should not approve the prime Contractor's request for termination.

The Department may provide a shorter response time if required in a particular case as a matter of public necessity.

The Department will consider both the Contractor's request and DBE's stated position prior to approving the request. The Department may provide a written approval only if it agrees, for reasons stated in its concurrence document, that the Contractor has good cause to terminate the DBE. If the Department does not approve the request, the Contractor must continue to use the committed DBE firm in accordance with the Contract. For guidance on what good cause includes, see 49 CFR 26.53.

Good cause does not exist if the Contractor seeks to terminate, reduce, or substitute a DBE it relied upon to obtain the Contract so that the Contractor can self-perform the work for which the DBE firm was engaged.

When a DBE subcontractor is terminated, make good faith efforts to find, as a substitute for the original DBE, another DBE to perform, at least to the extent needed to meet the established Contract goal, the work that the original DBE was to have performed under the Contract.

Submit the completed Form 4010, "DBE Termination Request," and Form 4011 "DBE Substitution Request," within seven (7) days, which may be extended for an additional 7 days, if necessary, at the request of the Contractor. The Department will provide a written determination to the Contractor stating whether or not good faith efforts have been demonstrated. If the Department determines that good faith efforts were not demonstrated, the Contractor will have the opportunity to appeal the determination to the Aviation Division.

- 2.3.11. **Reports and Records.** By the 15th of each month and after work begins, report payments to meet the DBE goal and for DBE race-neutral participation on projects with or without goals. These payment reports will be required until all DBE sub-contracting or material supply activity is completed. Negative payment reports are required when no activity has occurred in a monthly period.
- 2.3.12. Notify the Department if payment to any DBE subcontractor is withheld or reduced. Before receiving final payment from the Department, the Contractor must indicate a final payment on the compliance tracking system. The final payment is a summary of all payments made to the DBEs on the project. All records must be retained for a period of 3 years following completion of the Contract work and must be available at reasonable times and places for inspection by authorized representatives of the Department or the DOT. Provide copies of subcontracts or agreements and other documentation upon request.

2.3.13. **Failure to Comply.** If the Department determines the Contractor has failed to demonstrate good faith efforts to meet the assigned goal, the Contractor will be given an opportunity for reconsideration by the Department.

A Contractor's failure to comply with the requirements of this Special Provision will constitute a material breach of this Contract. In such a case, the Department reserves the right to terminate the Contract; to deduct the amount of DBE goal not accomplished by DBEs from the money due or to become due the Contractor; or to secure a refund, not as a penalty but as liquidated damages, to the Department or such other remedy or remedies as the Department deems appropriate.

2.3.14. **Investigations.** The Department may conduct reviews or investigations of participants as necessary. All participants, including, but not limited to, DBEs and complainants using DBE Subcontractors to meet the Contract goal, are required to cooperate fully and promptly with compliance reviews, investigations, and other requests for information.

2.3.15. **Falsification and Misrepresentation.** If the Department determines that a Contractor or subcontractor was a knowing and willing participant in any intended or actual subcontracting arrangement contrived to artificially inflate DBE participation or any other business arrangement determined by the Department to be unallowable, or if the Contractor engages in repeated violations, falsification, or misrepresentation, the Department may:

- refuse to count any fraudulent or misrepresented DBE participation;
- withhold progress payments to the Contractor commensurate with the violation;
- reduce the Contractor's prequalification status;
- refer the matter to the Office of Inspector General of the US Department of Transportation for investigation; and/or
- seek any other available contractual remedy.

2.3.16. **Prompt Payment.** Texas Administrative Code, Title 43, Rule 9.208 requires contractors to promptly pay all subcontractors within 10 days after the date that the contractor receives payment for work performed by a subcontractor. In order to enforce Rule 9.208, the Contractor shall list the name and amount of each subcontract including DBE subcontractors that are proposed to meet the DBE goal, if any, in the CTS. The contractor will report payments to each subcontractor on a monthly basis and list reasons for nonpayment in the CTS.

**DBE PARTICIPATION PLAN**

**MUST BE SUBMITTED AND RECEIVED NO LATER THAN 5 CALENDAR DAYS FROM BID OPENING at the following email address: [AVNRFQ@txdot.gov](mailto:AVNRFQ@txdot.gov)**

<b>TxDOT Project No.: 2618MSQTE</b>	<b>Project Airport: Mesquite Metro Airport</b>
<b>Percentage Goal: 0%</b>	<b>Contractor:</b>
<b>Contractor Bid Amount:</b>	<b>Notes:</b>

I propose to use the following DBE Plan in accordance with the requirements of the Disadvantaged Business Enterprise

<b>TX TAX Vendor Number (11 Digit #)</b>	<b>Name of DBE Sub/Supplier*</b>	<b>Type of Work</b>	<b>Amount (\$)</b>
			\$
			\$
			\$
			\$
			\$
<b>b) Total Dollar Value of Participation</b>			\$

Assurances Attachment of the bid document and intend to utilize the following DBE firm(s) in performance of the contract. **Commitment Agreement Forms from these DBE firm(s) are attached to this DBE Participation Plan.**

\*The VENDOR NUMBER(s) and SUBCONTRACTOR NAME(s) supplied on this report must match what appears in the Texas Unified Certification Program (TUCP) Directory.

Acceptance of this DBE Participation Plan fulfills the requirements for only this DBE contract(s), between General Contractor and Subcontractor(s).

\_\_\_\_\_  
Signature of Company Official

\_\_\_\_\_  
Date

**Construction Contractors:**

Please download the appropriate DBE Commitment Agreement or Good faith effort form from the TxDOT website at <http://www.txdot.gov/business/partnerships/dbe-forms.html>. There are three available DBE commitment forms.

- 1) DBE Commitment Agreement Form No. SMS.4901,
- 2) DBE Program Material/Supplier Form No. SMS.4901-MS and
- 3) DBE Trucking Commitment Form No. SMS.4901-T.

You must pick which commitment applies to your subcontract agreement. Then you and your DBE/s must complete the form and return it with the signed DBE plan by the required date.

- 4) Form 4000 Contractor's Certification Good Faith Effort **(if unable to meet specified goal)**

# **SPECIAL PROVISIONS**

## SPECIAL PROVISIONS

The following Special Provisions modify, amplify, or amend the Construction Contract General Provisions (February 2013) with respect to the clauses cited below and no other clauses or requirements of these items are waived or changed hereby. The Special Provisions shall take precedence over the General Provisions.

SP-1 TxDOT, Aviation will not withhold retainage in any amount on any partial payment made to the contractor. The contractor is eligible to receive payment up to 95% of the contract amount or installed work items if over or under the current contract amount before final acceptance of the project. Final payment will be made after acceptance of the work by the Engineer and TxDOT.

SP-2 Add to Section 90-06 PARTIAL PAYMENTS:

Upon receipt and approval of each partial payment request, the Agent shall pay the approved partial amount which is due and payable as provided herein within thirty (30) days of receipt by TxDOT Aviation.

SP-3 Add to Section 90-09 ACCEPTANCE AND FINAL PAYMENT

Upon receipt and approval of the final payment request, the Agent shall pay the approved final amount which is due and payable as provided herein within thirty (30) days of receipt by TxDOT Aviation.

SP-4 Add to Section 80-01 Subcontracting of Contract:

**The following is applicable on contracts equal to or greater than \$500,000:**

The prime contractor shall perform work with its own organization on at least 30% of the total original contract cost. The term “perform work with own organization” includes only:

- workers employed and paid directly by the Contractor or wholly owned subsidiary;
- equipment owned by the Contractor or wholly owned subsidiary;
- rented or leased equipment operated by the Contractor’s employees or wholly owned subsidiary’s employees;
- materials incorporated into the work; and
- labor provided by staff leasing firms licensed under Chapter 91 of the Texas Labor Code for nonsupervisory personnel if the Contractor or wholly owned subsidiary maintains direct control over the activities of the leased employees and includes them in the weekly payrolls. When staff leasing firms provide materials or equipment, they are considered subcontractors. In these instances, approval of staff leasing firms as a subcontractor may be required. Copies of cancelled checks and certified statements may be required to verify compliance with the requirements of this Section.

On projects with Performance Bonds, this requirement will be suspended if the contractor defaults and a takeover agreement is executed.

SP-5 Add Additional Federal Provisions

### **Compliance with Nondiscrimination Requirements**

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

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

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:
  - a. Withholding payments to the contractor under the contract until the contractor complies; and/or
  - b. Cancelling, terminating, or suspending a contract, in whole or in part.
6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

(Source: Appendix E of Appendix 4 of FAA Order 1400.11, Nondiscrimination in Federally Assisted Programs at the Federal Aviation Administration)

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

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination in Federally-Assisted Programs of The Department of Transportation—Effectuation of Title VI of The Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);

- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration’s Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq.).

## **FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)**

(Reference: 29 USC § 201, et seq.)

### **APPLICABILITY**

The federal minimum wage provisions are contained in the Fair Labor Standards Act (FLSA) which is administered by the United States Department of Labor Wage and Hour Division. All contracts and subcontracts must meet and comply with the FLSA, including the recordkeeping standards of the Act.

**MANDATORY CONTRACT LANGUAGE**

All contracts and subcontracts that result from this solicitation incorporate the following provisions by reference, with the same force and effect as if given in full text. The contractor has full responsibility to monitor compliance to the referenced statute or regulation. The contractor must address any claims or disputes that pertain to a referenced requirement directly with the Federal Agency with enforcement responsibilities.

<b>Requirement</b>	<b>Federal Agency with Enforcement Responsibilities</b>
Federal Fair Labor Standards Act (29 USC 201)	U.S. Department of Labor – Wage and Hour Division

**OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970**

(Reference 20 CFR part 1910)

**APPLICABILITY**

The United States Department of Labor Occupational Safety & Health Administration (OSHA) oversees the workplace health and safety standards wage provisions from the Occupational Safety and Health Act of 1970. All contracts and subcontracts must meet and comply with the Occupational Safety and Health Act of 1970.

**MANDATORY CONTRACT LANGUAGE**

All contracts and subcontracts that result from this solicitation incorporate the following provisions by reference, with the same force and effect as if given in full text. The contractor has full responsibility to monitor compliance to the referenced statute or regulation. The contractor must address any claims or disputes that pertain to a referenced requirement directly with the Federal Agency with enforcement responsibilities.

<b>Requirement</b>	<b>Federal Agency with Enforcement Responsibilities</b>
Occupational Safety and Health Act of 1970 (20 CFR Part 1910)	U.S. Department of Labor – Occupational Safety and Health Administration

**ACCESS TO RECORDS AND REPORTS.**

(Reference: 2 CFR § 200.326, 2 CFR § 200.333)

**APPLICABILITY**

Applies to all AIP-funded projects and must be included in all contracts and subcontracts.

**MANDATORY CONTRACT LANGUAGE**

The mandatory language that must be used on AIP funded project contracts is as follows:

## **ACCESS TO RECORDS AND REPORTS**

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

## **TRADE RESTRICTION**

(Reference: 49 CFR part 30)

## **APPLICABILITY**

The trade restriction clause applies to all AIP-funded projects and must be included in all contracts and subcontracts.

## **MANDATORY CONTRACT LANGUAGE**

The mandatory language is as follows:

### **TRADE RESTRICTION CLAUSE**

The contractor or subcontractor, by submission of an offer and/or execution of a contract, certifies that it:

- a. is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms published by the Office of the United States Trade Representative (USTR);
- b. has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country on said list, or is owned or controlled directly or indirectly by one or more citizens or nationals of a foreign country on said list;
- c. has not procured any product nor subcontracted for the supply of any product for use on the project that is produced in a foreign country on said list.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to a contractor or subcontractor who is unable to certify to the above. If the contractor knowingly procures or subcontracts for the supply of any product or service of a foreign country on said list for use on the project, the Federal Aviation Administration may direct through the Sponsor cancellation of the contract at no cost to the Government.

Further, the contractor agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in each contract and in all lower tier subcontracts. The contractor may rely on the certification of a prospective subcontractor unless it has knowledge that the certification is erroneous.

The contractor shall provide immediate written notice to the sponsor if the contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The subcontractor agrees to provide written notice to the contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

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

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

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

## **BREACH OF CONTRACT TERMS**

(Reference 2 CFR § 200 Appendix II(A))

### **APPLICABILITY**

This provision is required in all contracts that exceed the simplified acquisition threshold. This threshold, fixed at 41 USC 403(11), is presently set at \$100,000.

### **MANDATORY CONTRACT LANGUAGE**

The regulation does not prescribe mandatory language; however, the following clause represents sample language that meets the intent of 2 CFR § 200 Appendix II(A). This provision requires grantees to incorporate administrative, contractual or legal remedies in instances where contractors violate or breach contract terms.

## **BREACH OF CONTRACT TERMS**

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

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

### **CLEAN AIR AND WATER POLLUTION CONTROL.**

(Reference: 49 CFR § 18.36(i)(12)) Note, when the DOT adopts 2 CFR 200, this reference will change to 2 CFR § 200 Appendix II(G))

### **APPLICABILITY.**

Incorporate in all professional service agreements, construction contracts and subcontracts that exceed \$100,000. (Note that the 2 CFR 200 will raise this level to \$150,000)

### **MANDATORY CONTRACT LANGUAGE.**

#### **CLEAN AIR AND WATER POLLUTION CONTROL**

Contractors and subcontractors agree:

1. That any facility to be used in the performance of the contract or subcontract or to benefit from the contract is not listed on the Environmental Protection Agency (EPA) List of Violating Facilities;
2. To comply with all the requirements of Section 114 of the Clean Air Act, as amended, 42 U.S.C. 1857 et seq. and Section 308 of the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq. relating to inspection, monitoring, entry, reports, and information, as well as all other requirements specified in Section 114 and Section 308 of the Acts, respectively, and all other regulations and guidelines issued thereunder;
3. That, as a condition for the award of this contract, the contractor or subcontractor will notify the awarding official of the receipt of any communication from the EPA indicating that a facility to be used for the performance of or benefit from the contract is under consideration to be listed on the EPA List of Violating Facilities;
4. To include or cause to be included in any construction contract or subcontract which exceeds \$100,000 the aforementioned criteria and requirements.

### **CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS.**

(Reference: 2 CFR § 200 Appendix II (E))

## **APPLICABILITY.**

Incorporate in all professional service agreements, construction contracts and subcontracts that exceed \$100,000.

## **MANDATORY CONTRACT LANGUAGE**

### **CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS**

#### 1. Overtime Requirements.

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

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

In the event of any violation of the clause set forth in paragraph (1) above, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 above, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1 above.

#### 3. Withholding for Unpaid Wages and Liquidated Damages.

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

4. Subcontractors.

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

**CERTIFICATION OF OFFERER/BIDDER REGARDING TAX DELINQUENCY AND FELONY CONVICTIONS**

The Engineer certifies, by acceptance of this Agreement, that the Engineer:

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

If the Engineer cannot certify both of the above representations, the Engineer is ineligible to accept this Agreement unless the Agent has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The Engineer therefore must provide information to the Agent and the Sponsor about its tax liability or conviction to the Agent and the Sponsor, who will then notify the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the required considerations before award decisions are made. The Engineer agrees that it will incorporate this provision for certification in all lower tier subcontracts.

**VETERAN'S PREFERENCE**

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

## **ENERGY CONSERVATION REQUIREMENTS**

Contractor and Subcontractor agree to comply with mandatory standards and policies relating to energy efficiency as contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 USC 6201et seq.).

## **TEXTING WHEN DRIVING**

In accordance with Executive Order 13513, “Federal Leadership on Reducing Text Messaging While Driving”, (10/1/2009) and DOT Order 3902.10, “Text Messaging While Driving”, (12/30/2009), the Federal Aviation Administration encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or subgrant. In support of this initiative, the Owner encourages the Contractor to promote policies and initiatives for its employees and other work personnel that decreases crashes by distracted drivers, including policies that ban text messaging while driving motor vehicles while performing work activities associated with the project. The Contractor must include the substance of this clause in all sub-tier contracts exceeding \$3,500 that involve driving a motor vehicle in performance of work activities associated with the project.

### SP-6 Add Notice Regarding Certificate of Interested Parties

A contract for \$1,000,000 or more will not be issued until the selected contractor submits a signed and notarized Certificate of Interested Parties (Form 1295), along with a Certification of Filing. The Certification of Filing may be obtained through the Texas Ethics Commission’s filing application, [https://www.ethics.state.tx.us/whatsnew/elf\\_info\\_form1295.htm](https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm).

The awarded contractor shall submit these documents with the signed agreement.

The Certificate of Interested Parties is mandated by Government Code §2252.908 and 1 Tex. Admin. Code §46.5.

### SP-7 Change or replace definitions in Section 10

10-16 CHANGE ORDER. A written order to the Contractor covering changes in the plans, specifications, quantities and/or any other modification to the contract and establishes the basis of payment and contract time adjustment, if any, for the work affected by such changes.

10-47 SUPPLEMENTAL AGREEMENT. Written agreement entered into between the Contractor and the Agent and approved by the Surety, covering alterations and changes in the Contract. A supplemental agreement is used whenever the modifications include assignment of the Contract from one entity to another or other cases as desired by TxDOT.

SP-8 Amend the second and third paragraphs in Section 40-02.

A Change Order will be issued covering significant changes to the Contract. Significant changes occur when (1) the aggregate amount of altered work increases or decreases the awarded contract, or any major contract item, by more than 25 percent, assuming such increased or decreased work is within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract. Provide cost justification as requested, in an acceptable format. Payment will not be made for anticipated profits on work that is eliminated. These alterations and changes will not invalidate the Contract nor release the Surety. The Contractor is responsible for notifying the surety of any changes to the Contract. If TxDOT and the Contractor are unable to agree on a unit adjustment for any significant changes, it reserves the right to terminate negotiations with respect to the significant changes and make other arrangements for completion.

For AIP contracts, all change orders and/or supplemental agreements shall be approved by TxDOT and shall include valid wage determinations of the U.S. Secretary of Labor when the amount of the change order/supplemental agreement exceeds \$2,000. However, if the contractor elects to waive the limitations on work that increases or decreases the originally awarded contract or any major contract item by more than 25 percent, the change order/supplemental agreement shall be subject to the same U.S. Secretary of Labor wage determination as was included in the originally awarded contract.

Delete the fourth paragraph in Section 40-02 as this is now covered in Section 10

40-03 OMITTED ITEMS. The Engineer may, in TxDOT's best interest, omit any contract item except major contract items. Such omissions of contract items shall not invalidate any other contract provision or requirement.

40-04 EXTRA WORK. Extra work that is necessary for acceptable completion of the project but is not within the general scope of the work covered by the original contract shall be covered by a Change Order as herein before defined in the subsection titled CHANGE ORDER of Section 10.

SP-9 CONSTRUCTION CONTRACT GENERAL PROVISIONS, VOLUME FEBRUARY 2013, SECTION 20

Delete the following sentence from Section 20-02 BID REQUIREMENTS AND CONDITIONS: "Each bidder shall submit written evidence from the State Comptroller's office that all applicable franchise taxes owed the State of Texas have been paid."

Delete Section 20-03 CONTENTS OF BID FORMS in its entirety and replace with: 20-03 CONTENTS OF BID FORMS. TxDOT shall furnish bidders with formatted bid forms. All statements, certifications, and other qualifications indicated in "Instructions to Bidders" or attached to the bid forms are necessary parts.

The Bidder must submit the completed bid on the bid form furnished by TxDOT, with all blank spaces in the TxDOT bid form correctly typed in for each and every item for which a quantity is given.

The Bidder shall sign the bid in ink. If the bid is made by an individual, the individual's name and address must be shown. If made by a partnership, the name and address of each member of the partnership must be shown. If made by a corporation, the person signing the bid shall give the name of the state under the laws of which the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer.

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

The Bidder may also submit an electronically printed bid. The bid must have pay items in the same order and with the exact information as on this bid form. If submitting an electronically printed bid, submit qualification/signature page of the bid form. The bidder is responsible for incorrect information and will be considered non-responsive if pay items are incorrect.

Delete the following sentences from Section 20-06 PREPARATION OF BID

“Make entries in ink.”

“As an Alternative to hand-writing the unit prices in works in ink in the bid, submit a computer printout signed by the person authorized to bind the bidder. In the case of a joint venture, the persons authorized to bid the Bidders must sign the computer printout. As a General Provisions GP-20-3 minimum, computer printouts must contain the information in the format shown on the “Example of Bid Prices Submitted by Computer Printout” form in the bid.”

Add the following sentence to Section 20-06 PREPARATION OF BID:

“The bidder may also submit an electronically printed bid. The bid must have pay items in the same order and with the exact information as on this bid form. If submitting an electronically printed bid include signed qualification/signature page form the bid form. The bidder is responsible for incorrect information and will be considered non-responsive if pay items are incorrect.”

Change Section 20-06 PREPARATION OF BID, from “Execute the bid in ink.” to “Sign the bid in ink.”

Delete Items “I” from Section 20-07 NON-RESPONSIVE BIDS.

Delete the following sentence in Section 30-01 CONSIDERATION OF BIDS “If a bidder’s bid contains a discrepancy between unit bid prices written in words and unit bid prices written in numbers, the unit price written in words shall govern, unless obviously incorrect.

SP-10

Change DEFINITION OF TERMS Section 10-11 BID to read:

The offer of the bidder, when submitted on the approved formatted bid form or electronically printed alternative with qualifications/signature page, to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.

SP-11

The Agent, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

SP-12

Israel Boycott Certification and Prohibition: Pursuant to Texas Govt. Code Chap. 808 (HB89) and Chap. 2270 (SB253):

(a) "Boycott Israel" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

(b) Bidder hereby certifies (1) it does not boycott Israel, and (2) shall not boycott Israel during the term of contract agreement.

# **WAGE RATES**

"General Decision Number: TX20260294 01/02/2026

Superseded General Decision Number: TX20250294

State: Texas

Construction Type: Highway

Counties: Collin, Dallas, Delta, Denton, Ellis, Grayson, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant and Wise Counties in Texas.

HIGHWAY CONSTRUCTION PROJECTS

Modification Number      Publication Date  
0                              01/02/2026

SATX2025-007 11/15/2023

	Rates	Fringes
Asphalt Distributor Operator.....	\$ 24.40	0.00
Asphalt Paving Machine Operator.....	\$ 22.52	0.00
Asphalt Raker.....	\$ 19.87	0.00
Broom or Sweeper Operator.....	\$ 18.01	0.00
Concrete Finisher, Paving and Structures.....	\$ 22.48	0.00
Concrete Pavement Finishing Machine Operator.....	\$ 24.07	0.00
Concrete Saw Operator.....	\$ 20.34	0.00
Crane Operator, Hydraulic 80 tons or less.....	\$ 31.32	0.00
Crane Operator, Lattice Boom 80 Tons or Less.....	\$ 29.90	0.00
Crane Operator, Lattice Boom Over 80 Tons.....	\$ 33.55	0.00
Crawler Tractor Operator.....	\$ 24.06	0.00
Electrician.....	\$ 36.10	0.00
Excavator Operator, 50,000 pounds or less.....	\$ 25.08	0.00
Excavator Operator, Over 50,000 pounds.....	\$ 25.34	0.00
Flagger.....	\$ 14.80	0.00
Form Builder/Setter, Structures.....	\$ 22.50	0.00
Form Setter, Paving & Curb.....	\$ 20.89	0.00

Foundation Drill Operator, Crawler Mounted.....	\$ 29.25	0.00
Foundation Drill Operator, Truck Mounted.....	\$ 29.86	0.00
Front End Loader Operator, 3 CY or Less.....	\$ 20.93	0.00
Front End Loader Operator, Over 3 CY.....	\$ 22.56	0.00
Laborer, Common.....	\$ 18.01	0.00
Laborer, Utility.....	\$ 19.32	0.00
Loader/Backhoe Operator.....	\$ 23.22	0.00
Mechanic.....	\$ 27.44	0.00
Milling Machine Operator.....	\$ 20.94	0.00
Motor Grader Operator, Fine Grade.....	\$ 27.09	0.00
Motor Grader Operator, Rough.....	\$ 24.90	0.00
Off Road Hauler.....	\$ 23.70	0.00
Pavement Marking Machine Operator.....	\$ 22.35	0.00
Pipelayer.....	\$ 22.46	0.00
Reclaimer/Pulverizer Operator....	\$ 22.17	0.00
Reinforcing Steel Worker.....	\$ 23.50	0.00
Roller Operator, Asphalt.....	\$ 20.35	0.00
Roller Operator, Other.....	\$ 18.60	0.00
Scraper Operator.....	\$ 21.54	0.00
Servicer.....	\$ 24.86	0.00
Sign Erector.....	\$ 18.01	0.00
Small Slipform Machine Operator.....	\$ 25.09	0.00
Spreader Box Operator.....	\$ 23.59	0.00
Telecommunication Technician.....	\$ 23.14	0.00
Truck Driver Lowboy Float.....	\$ 25.57	0.00
Truck Driver, Single Axle.....	\$ 20.60	0.00
Truck Driver, Single or Tandem Axle Dump Truck.....	\$ 22.64	0.00
Truck Driver, Tandem Axle Tractor with Semi Trailer.....	\$ 23.22	0.00

Truck Driver, Transit-Mix.....	\$ 21.97	0.00
Welder.....	\$ 23.72	0.00
Work Zone Barricade Servicer.....	\$ 18.01	0.00

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

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

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.30 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 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

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

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

## Union Rate Identifiers

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

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

## Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

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

## Survey Rate Identifiers

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

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

## State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the

state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

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WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

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

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

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

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

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

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END OF GENERAL DECISION

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# **TECHNICAL SPECIFICATIONS**

# TAXILANE RECONSTRUCTION/WIDENING AND APRON CONSTRUCTION

2618MSQTE

## Technical Specifications

### FAA Standard Specifications

1. **Item C-100** Contractor Quality Control Program (CQCP)
2. **Item C-102** Temporary Air and Water Pollution, Soil Erosion, and Siltation Control
3. **Item C-105** Mobilization
4. **Item C-110** Method of Estimating Percentage Within Specification Limits (PWL)
5. **Item P-101** Preparation- Removal of Existing Pavements
6. **Item P-152** Excavation, Subgrade and Embankment
7. **Item P-153** Controlled Low Strength Material (CLSM)
8. **Item P-154** Subbase Course
9. **Item P-155** Lime-Treated Subgrade
10. **Item P-501** Cement Concrete Pavement
11. **Item P-605** Joint Sealants for Pavements
12. **Item P-610** Concrete for Miscellaneous Structures
13. **Item P-620** Runway and Taxiway Marking
14. **Item D-701** Pipe for Storm Drains and Culverts
15. **Item D-752** Concrete Culverts, Headwalls, and Miscellaneous Drainage Structures
16. **Item D-754** Concrete Gutters, Ditches, and Flumes
17. **Item T-904** Sodding
18. **Item T-905** Topsoil
19. **Item L-108** Underground Power Cable for Airports
20. **Item L-110** Airport Underground Electrical Duct Banks and Conduits
21. **Item L-115** Electrical Manholes and Junction Structures
22. **Item L-125** Installation of Airport Lighting Systems

### TxDot Technical Specifications

23. **Item TxDOT 168** Vegetative Watering

### Additional Technical Specifications

24. **Item KSA-100** Project Schedule, Mobilization, and Field Office
25. **Item KSA-101** Shop Drawings, Project Data, and Samples
26. **Item KSA-105** Safety and Security
27. **Item KSA-209** Concrete Riprap



3/23/26

## Technical Specifications Reference

TBPE Firm Registration No. F-1356

The technical specifications included herein were prepared from the following sources:

- Federal Aviation Administration specifications (C-###, D-###, L-###, P-###, T-###) from Advisory Circular 150/5370-10H.
- Standard Specifications for Construction and Maintenance of Highways, Street, and Bridges (TxDOT###) Adopted by the Texas Department of Transportation, September 1, 2024
- Project specific specifications (KSA-###) prepared by the Engineer

Additions to standard technical specifications are identified by **highlight** for added items and ~~strikethrough~~ for deleted items. The technical specifications also have a modification sheet preceding the specification that modifies, amplifies, or amends the technical specification and plans. The modification sheet takes precedence over the plans and technical specifications. It is the contractor's responsibility to read and understand the requirements of the project specifications and modifications. Throughout the specifications there are many instances when "RPR" or "Resident Project Representative" are referenced and "Engineer" has either been added to this reference or has taken the place of this reference. These instances are not included in the modification sheets.



## **Summary of Modifications**

### **Item C-100 Contractor Quality Control Program (CQCP)**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as Engineer RPR.

Revisions to include the use of Engineer or RPR may be shown throughout the document as Engineer and/or RPR.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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

The Contractor shall establish a CQCP that will:

- a. Provide qualified personnel to develop and implement the CQCP.
- b. Provide for the production of acceptable quality materials.
- c. Provide sufficient information to assure that the specification requirements can be met.
- d. Document the CQCP process.

The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the CQCP has been reviewed and approved by the Engineer 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 Engineer, 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 Engineer RPR on time and location of the QC/QA workshop. The workshop can take place as part of the pre-construction meeting. 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.

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

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

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

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

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

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

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

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

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

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

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

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

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

These records must cover both conforming and defective or deficient features and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the **Engineer and 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 **Engineer and 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 **Engineer and 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.

### Item C-100 Contractor Quality Control Program (CQCP)

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

The Contractor shall establish a CQCP that will:

- a. Provide qualified personnel to develop and implement the CQCP.
- b. Provide for the production of acceptable quality materials.
- c. Provide sufficient information to assure that the specification requirements can be met.
- d. Document the CQCP process.

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

The QC requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the quality assurance (QA) testing requirements. QA testing requirements are the responsibility of the **Engineer**, 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 ~~Engineer RPR~~ **Engineer** on time and location of the QC/QA workshop. **The workshop can take place as part of the pre-construction meeting.** Items to be addressed, at a minimum, will include:

- a. Review of the CQCP including submittals, QC Testing, Action & Suspension Limits for Production, Corrective Action Plans, Distribution of QC reports, and Control Charts.
- b. Discussion of the QA program.
- c. Discussion of the QC and QA Organization and authority including coordination and information exchange between QC and QA.
- d. Establish regular meetings to discuss control of materials, methods and testing.
- e. Establishment of the overall QC culture.

**100-2 Description of program.**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- a. Specification item number
- b. Item description
- c. Description of submittal
- d. Specification paragraph requiring submittal

e. Scheduled date of submittal

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

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

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

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

**100-7 Contractor QC testing facility.**

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

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

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

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

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

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

- a. Specification item number (e.g., P-401)
- b. Item description (e.g., Hot Mix Asphalt Pavements)
- c. Test type (e.g., gradation, grade, asphalt content)
- d. Test standard (e.g., ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)

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

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

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

The QC testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The **Engineer and 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 **Engineer and 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 **Engineer and 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 **Engineer and 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 **Engineer and RPR**.** All items of material and equipment are subject to inspection and/or observation by the **Engineer and 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 **Engineer and RPR** at the site for the same purpose.

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

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

### METHOD OF MEASUREMENT

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

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

### BASIS OF PAYMENT

**100-14 Payment will be made under:**

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

### REFERENCES

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

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

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

**END OF ITEM C-100**



## **Summary of Modifications**

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

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as Engineer RPR.

Revisions to include the use of Engineer or RPR may be shown throughout the document as Engineer and/or RPR.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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

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

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

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

**The work to be performed under this Section shall consist of furnishing all permits, preparation and implementation of a Stormwater Pollution Plan (SWPPP), a notice of intent, a notice of termination, labor, equipment, materials, and all permit fees as necessary to meet the requirements of the Texas Pollution Discharge Elimination System (TPDES) associated with construction activities under TPDES Construction General Permit TXR150000 for storm water pollution prevention as required by current Federal, State, and Local rules and regulations as shown and specified. The permit requirements differ based upon the acreage disturbed.**

**102-2.1 Grass.** Grass that will not compete with the ~~grasses sown~~ sod placed later for permanent cover per Item T-9044 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

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

**Submittals: The following items shall be submitted for record purposes only. These documents will not be reviewed for compliance with permit requirements.**

- A. SWPPP.**
- B. Notice of Intent (NOI),**
- C. Photocopies of permit application fee payment(s), and**
- D. Notice of Termination (NOT).**

**SWPPP Requirements: The SWPPP shall comply with the requirements of TPDES Construction General Permit TXR150000. A copy of the permit can be obtained by contacting the Texas Commission on Environmental Quality (TCEQ) at P.O. Box 13087, Austin, TX 78711-3087 or on their website.**

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

**The Contractor shall bear sole responsibility for the SWPPP provisions of this contract as well as bear sole responsibility for the development, implementation, and maintenance of the SWPPP, best management practices, and facilities utilized to meet the TPDES Construction General Permit TXR150000 requirements. The SWPPP and Notice of Intent shall be completed prior to beginning any work or stockpiling of materials.**

**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 Engineer RPR.

**Prior to filing the Notice of Intent, the Contractor shall develop and submit a project specific SWPPP based on the requirements of the current TCEQ and US Environmental Protection Agency (USEPA) rules.**

**After submittal of a project SWPPP as required by TXR150000, the Contractor shall file the NOI. A copy of the NOI shall be submitted to the Engineer for record purposes.**

**The Contractor shall pay all fees, including initial application and renewal fees, associated with the TPDES permit application. A photocopy of payments shall be submitted to the Engineer.**

**The Contractor shall pay all costs associated with the development of the SWPPP as well as the implementation, maintenance, monitoring, and inspection of the SWPPP facilities during the construction period.**

**Upon closeout of the Project, the Contractor shall submit a NOT to the TCEQ using proper forms and provide a copy to the Engineer for record purposes.**

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

The **Engineer 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.

**SWPPP: The Contractor shall implement the best management practices, storm water controls, structural controls, inspections, and all other aspects as detailed in their site specific SWPPP for this project. Controls shall be installed and maintained in accordance with the contract documents.**

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

- a. Installation and removal of silt fence will be measured by the linear foot. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation and maintenance of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.
- b. Installation and removal of erosion control logs will be measured by the linear feet installed and accepted by the Engineer in accordance with the plans and specifications. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation and maintenance of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

- c.** Rock Construction Exits will be measured by each exit installed and accepted by the Engineer in accordance with the plans and specifications. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation and maintenance of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.
- d.** All work performed and materials furnished as prescribed for the Stormwater Pollution Prevention Plan (SWP3) Document shall be measured as a lump sum price for “Stormwater Pollution Prevention Plan (SWP3) Document”. The total lump sum shall be paid pro-rata per month and the monthly amount shall be calculated by dividing the lump sum by the contract time in months. If the Contractor fails to update the SWP3, and provide and properly maintain control measures in compliance with the Contract requirements, as determined by the Engineer, the Contractor will be considered in noncompliance with this Item. Each month’s pay request will not be processed until the SWP3 has been updated. The total payment for this Item will not exceed 10% of the total Contract amount before 70% native vegetative cover has been established or final stabilization has been approved by the Engineer and the NOT has been submitted in accordance with the TPDES GP TXR150000. If all work is completed in accordance with the TPDES GP TXR 150000 and accepted by the Engineer and before payment of the amount allowed by this Item, the balance due shall be paid on the next estimate after the Engineer’s approval that 70% native background vegetative cover is met or equivalent permanent stabilization have been employed in accordance with the TPDES GP TXR 150000.

## 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 ~~Engineer Resident Project Representative (RPR)~~ during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

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

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

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

**The work to be performed under this Section shall consist of furnishing all permits, preparation and implementation of a Stormwater Pollution Plan (SWPPP), a notice of intent, a notice of termination, labor, equipment, materials, and all permit fees as necessary to meet the requirements of the Texas Pollution Discharge Elimination System (TPDES) associated with construction activities under TPDES Construction General Permit TXR150000 for storm water pollution prevention as required by current Federal, State, and Local rules and regulations as shown and specified. The permit requirements differ based upon the acreage disturbed.**

### MATERIALS

**102-2.1 Grass.** Grass that will not compete with the ~~grasses sown~~ sod placed later for permanent cover per Item T-904 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

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

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

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

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

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

**Submittals: The following items shall be submitted for record purposes only. These documents will not be reviewed for compliance with permit requirements.**

- A. SWPPP.**
- B. Notice of Intent (NOI),**
- C. Photocopies of permit application fee payment(s), and**
- D. Notice of Termination (NOT).**

**SWPPP Requirements: The SWPPP shall comply with the requirements of TPDES Construction General Permit TXR150000. A copy of the permit can be obtained by contacting the Texas Commission on Environmental Quality (TCEQ) at P.O. Box 13087, Austin, TX 78711-3087 or on their website.**

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

**The Contractor shall bear sole responsibility for the SWPPP provisions of this contract as well as bear sole responsibility for the development, implementation, and maintenance of the SWPPP, best management practices, and facilities utilized to meet the TPDES Construction General Permit TXR150000 requirements. The SWPPP and Notice of Intent shall be completed prior to beginning any work or stockpiling of materials.**

**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 Engineer RPR.

**Prior to filing the Notice of Intent, the Contractor shall develop and submit a project specific SWPPP based on the requirements of the current TCEQ and US Environmental Protection Agency (USEPA) rules.**

**After submittal of a project SWPPP as required by TXR150000, the Contractor shall file the NOI. A copy of the NOI shall be submitted to the Engineer for record purposes.**

**The Contractor shall pay all fees, including initial application and renewal fees, associated with the TPDES permit application. A photocopy of payments shall be submitted to the Engineer.**

**The Contractor shall pay all costs associated with the development of the SWPPP as well as the implementation, maintenance, monitoring, and inspection of the SWPPP facilities during the construction period.**

**Upon closeout of the Project, the Contractor shall submit a NOT to the TCEQ using proper forms and provide a copy to the Engineer for record purposes.**

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

The **Engineer 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.

**SWPPP: The Contractor shall implement the best management practices, storm water controls, structural controls, inspections, and all other aspects as detailed in their site specific SWPPP for this project. Controls shall be installed and maintained in accordance with the contract documents.**

**102-3.4 Installation, maintenance and removal of silt fence.** Silt fences shall extend a minimum of 16 inches (41 cm) and a maximum of 34 inches (86 cm) above the ground surface. Posts shall be set no more than 10 feet (3 m) on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch (300-mm) overlap and securely sealed. A trench shall be excavated approximately 4 inches (100 mm) deep by 4 inches (100 mm) wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The

fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the Engineer RPR.

### METHOD OF MEASUREMENT

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

- a. Installation and removal of silt fence will be measured by the linear foot. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation and maintenance of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.
- b. Installation and removal of erosion control logs will be measured by the linear feet installed and accepted by the Engineer in accordance with the plans and specifications. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation and maintenance of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.
- c. Rock Construction Exits will be measured by each exit installed and accepted by the Engineer in accordance with the plans and specifications. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation and maintenance of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.
- d. All work performed and materials furnished as prescribed for the Stormwater Pollution Prevention Plan (SWP3) Document shall be measured as a lump sum price for "Stormwater Pollution Prevention Plan (SWP3) Document". The total lump sum shall be paid pro-rata per month and the monthly amount shall be calculated by dividing the lump sum by the contract time in months. If the Contractor fails to update the SWP3, and provide and properly maintain control measures in compliance with the Contract requirements, as determined by the Engineer, the Contractor will be considered in noncompliance with this Item. Each month's pay request will not be processed until the SWP3 has been updated. The total payment for this Item will not exceed 10% of the total Contract amount before 70% native vegetative cover has been established or final stabilization has been approved by the Engineer and the NOT has been submitted in accordance with the TPDES GP TXR150000. If all work is completed in accordance with the TPDES GP TXR 150000 and accepted by the Engineer and before payment of the amount allowed by this Item, the balance due shall be paid on the next estimate after the Engineer's approval that 70% native background vegetative cover is met or equivalent permanent stabilization have been employed in accordance with the TPDES GP TXR 150000.

**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 Engineer RPR and measured as provided in paragraph 102-4.1 will be paid for under:

Item C-102-5.1a	Installation and removal of silt fence - per linear feet
Item C-102-5.1b	Erosion Control Logs – per linear feet

Item C-102-5.1c	Rock Construction Exit – per each
Item C-102-5.1d	Storm Water Pollution Prevention Plan (SWPPP) – per lump sum

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

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

### REFERENCES

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

#### Advisory Circulars (AC)

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

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

#### ASTM International (ASTM)

ASTM D6461                      *Standard Specification for Silt Fence Materials*

#### United States Department of Agriculture (USDA)

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

### END OF ITEM C-102

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## **Summary of Modifications**

### **Item C-105 Mobilization**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as **Engineer RPR**.

Revisions to include the use of Engineer or RPR may be shown throughout the document as **Engineer** and/or **RPR**.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**105-5 Contractor Final Project Documentation.** Final payment to contractor will be contingent upon completion of applicable items listed below and as appropriate, submittal of associated documentation and approval of documentation by the Engineer.

1. Two (2) copies of all manufacturer's warranties specified for materials, equipment, and installations.
2. Weekly payroll records (not previously received) from the general Contractor and all subcontractors.
3. Final cleanup in accordance with Section 40, paragraph 40-09, Final Cleaning Up.
4. Complete all punch list items identified during the Final Inspection.
5. Provide complete release of all claims for labor and material arising out of the Contract.
6. Submittal of required DBE documentation
7. Manufacturer's certifications for all items incorporated in the work.
8. All required record drawings, as-built drawings or as-constructed drawings.
9. Project Operation and Maintenance (O&M) Manual(s).
10. **Equipment commissioning documentation submitted, if required.**



### Item C-105 Mobilization

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

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

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

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

**105-5 Contractor Final Project Documentation.** Final payment to contractor will be contingent upon completion of applicable items listed below and as appropriate, submittal of associated documentation and approval of documentation by the Engineer.

1. Two (2) copies of all manufacturer’s warranties specified for materials, equipment, and installations.
2. Weekly payroll records (not previously received) from the general Contractor and all subcontractors.
3. Final cleanup in accordance with Section 40, paragraph 40-09, Final Cleaning Up.
4. Complete all punch list items identified during the Final Inspection.
5. Provide complete release of all claims for labor and material arising out of the Contract.
6. Submittal of required DBE documentation
7. Manufacturer's certifications for all items incorporated in the work.
8. All required record drawings, as-built drawings or as-constructed drawings.
9. Project Operation and Maintenance (O&M) Manual(s).
10. Equipment commissioning documentation submitted, if required.

### METHOD OF MEASUREMENT

**105-5 Basis of measurement and payment.** Based upon the contract lump sum price for “Mobilization” partial payments will be allowed as follows:

- a. With first pay request, 40%, not to exceed 4% of the total project cost.
- b. When 25% or more of the original contract is earned, an additional 25%, not to exceed 2.5% of the total project cost.
- c. When 50% or more of the original contract is earned, an additional 25%, not to exceed 2.5% of the total project cost.
- d. After Final Inspection, Staging area clean-up, and delivery of all Project Closeout materials as required by paragraph 105-5 above, any remaining amount to be paid.

### BASIS OF PAYMENT

**105-6 Payment will be made under:**

Item C-105 Mobilization – per lump sum

### REFERENCES

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

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246, as amended

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

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

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

**END OF ITEM C-105**

### Item C-110 Method of Estimating Percentage of Material Within Specification Limits (PWL)

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

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

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

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

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

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

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

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

$n$  = Number of subplot test values

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

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

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

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

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

$n$  = Number of subplot test values

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

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

Where: L = specification lower tolerance limit

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

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

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

and

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

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

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

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

Where:  $P_L$  = percent within lower specification limit

$P_U$  = percent within upper specification limit

### EXAMPLE OF PWL CALCULATION

**Project:** Example Project

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

#### A. PWL Determination for Mat Density.

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

A-1 = 96.60

A-2 = 97.55

A-3 = 99.30

A-4 = 98.35

$n = 4$

- (2) Calculate average density for the lot.

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

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

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

- (3) Calculate the standard deviation for the lot.

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

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

$$S_n = 1.15$$

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

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

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

$$Q_L = 1.4348$$

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

$$PWL = 98$$

#### B. PWL Determination for Air Voids.

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

$$A-1 = 5.00$$

$$A-2 = 3.74$$

$$A-3 = 2.30$$

$$A-4 = 3.25$$

- (2) Calculate the average air voids for the lot.

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

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

$$X = 3.57\%$$

- (3) Calculate the standard deviation  $S_n$  for the lot.

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

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

$$S_n = 1.12$$

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

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

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

$$Q_L = 1.3992$$

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

$$P_L = 97$$

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

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

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

$$Q_U = 1.2702$$

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

$$P_U = 93$$

(8) Calculate Air Voids PWL

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

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

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

**Project:** Example Project

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

#### A. Outlier Determination for Mat Density.

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

$$A-3 = 99.30$$

$$A-4 = 98.35$$

$$A-2 = 97.55$$

$$A-1 = 96.60$$

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

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

a. For measurements greater than the average:

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

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

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

b. For measurements less than the average:

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

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

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

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

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

OR

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

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

Percent Within Limits ( $P_L$ and $P_U$ )	Positive Values of Q ( $Q_L$ and $Q_U$ )							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4717	1.4829	1.4914
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653
87	1.0597	1.1100	1.1173	1.1192	1.1199	1.1204	1.1208	1.1212
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990
83	0.9939	0.9900	0.9785	0.9715	0.9671	0.9643	0.9624	0.9610
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686
70	0.6787	0.6000	0.5719	0.5582	0.5504	0.5454	0.5419	0.5394
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537
66	0.5563	0.4800	0.4545	0.4424	0.4355	0.4310	0.4280	0.4257
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4030	0.4001	0.3980
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2093
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566
55	0.1806	0.1500	0.1406	0.1363	0.1338	0.1322	0.1312	0.1304
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1049	0.1042
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0793	0.0786	0.0781
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260
50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Percent Within Limits (P <sub>L</sub> and P <sub>U</sub> )	Negative Values of Q (Q <sub>L</sub> and Q <sub>U</sub> )							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304
44	-0.2164	-0.1800	-0.1688	-0.1636	-0.1607	-0.1588	-0.1575	-0.1566
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4355	-0.4310	-0.4280	-0.4257
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105
30	-0.6787	-0.6000	-0.5719	-0.5582	-0.5504	-0.5454	-0.5419	-0.5394
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282
26	-0.7904	-0.7200	-0.6921	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8245	-0.8214	-0.8192
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4717	-1.4829	-1.4914
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5871	-1.6127	-1.6313	-1.6454
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6993	-1.7235	-1.7420
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8053	-1.8379	-1.8630
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362

**REFERENCES**

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

ASTM International (ASTM)

ASTM E178

Standard Practice for Dealing with Outlying Observations

**END OF ITEM C-110**

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## **Summary of Modifications**

### **Item P-101 Preparation/Removal of Existing Pavements**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as Engineer RPR.

Revisions to include the use of Engineer or RPR may be shown throughout the document as Engineer and/or RPR.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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#### **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. ~~If the material is to be wasted on the airport site, it shall be reduced to a maximum size of [---].~~ Concrete slabs that are damaged by under breaking shall be repaired or removed and replaced as directed by the Engineer RPR. All removed concrete pavement shall be disposed of off airport property.

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 pavement removal.** Asphalt pavement to be removed shall be cut to the full depth of the asphalt pavement around the perimeter of the area to be removed. If the material is to be incorporated into embankment, it shall be broken to a maximum size that does not exceed 2/3 of the loose lift thickness into which it is placed. All removed asphalt pavement that is not incorporated into embankment shall be disposed of off airport property. Pavement removal shall include removal of any base course beneath the pavement, regardless of type.

~~**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 Engineer 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 Engineer RPR. Fill all cracks greater than 1/4 inch (6 mm) 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 1/4 inch (6 mm). Any excess joint or crack sealer shall be removed from the pavement surface.~~

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

~~Chemicals, high pressure water, heater scarifier (asphalt concrete only), cold milling, rotary grinding, and sandblasting may be used. If chemicals are used, they shall comply with the state's environmental protection regulations. Removal methods used shall not cause major damage to the pavement, or to any structure or utility within or adjacent to the work area. Major damage is defined as changing the properties of the pavement, removal of asphalt causing the aggregate to ravel, or removing pavement over 1/8 inch (3 mm) deep. If it is deemed by the Engineer 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 Engineer RPR.~~

~~Removal of foreign substances shall not proceed until approved by the Engineer 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 Engineer 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 sized appropriately for the depth of the patch. The material shall be compacted with equipment approved by the Engineer 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 Engineer 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 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 of off Airport property. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material removed with new material at the Contractor's Expense.~~

~~**a. Patching.** The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The 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 7 feet and it shall be equipped with electronic grade control devices that will cut the surface to the grade specified. The tolerances shall be maintained within +0 inch and -1/4 inch (+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 windrow the millings or cuttings or remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of off the airport, unless incorporated into the embankment.~~

~~**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 of off Airport property.~~

~~**101-3.6. Preparation of asphalt pavement surfaces prior to surface treatment.** 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.~~

~~**101-3.9 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 Engineer and 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 or random crack saw 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 Crack Sealant.** Existing sealants will be removed by routing or random crack saw. Following routing or sawing 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-605.~~



## Item P-101 Preparation/Removal of Existing Pavements

### DESCRIPTION

**101-1** This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable plans.

### EQUIPMENT AND MATERIALS

**101-2** All equipment and materials shall be specified here and in the following paragraphs or approved by the ~~Engineer Resident Project Representative (RPR)~~. The equipment shall not cause damage to the pavement to remain in place.

### CONSTRUCTION

#### 101-3.1 Removal of existing pavement.

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

**a. Concrete pavement removal.** 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. ~~If the material is to be wasted on the airport site, it shall be reduced to a maximum size of [ ]~~. Concrete slabs that are damaged by under breaking shall be repaired or removed and replaced as directed by the ~~Engineer RPR~~. ~~All removed concrete pavement shall be disposed of off airport property.~~

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 pavement removal.** Asphalt pavement to be removed shall be cut to the full depth of the asphalt pavement around the perimeter of the area to be removed. If the material is to be incorporated into embankment, it shall be broken to a maximum size that does not exceed 2/3 of the loose lift thickness into which it is placed. All removed asphalt pavement that is not incorporated into embankment shall be disposed of off airport property. Pavement removal shall include removal of any base course beneath the pavement, regardless of type.

~~**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 ~~Engineer 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 Engineer RPR. Fill all cracks greater than 1/4 inch (6 mm) 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 1/4 inch (6 mm). Any excess joint or crack sealer shall be removed from the pavement surface.~~

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

~~Chemicals, high pressure water, heater scarifier (asphalt concrete only), cold milling, rotary grinding, and sandblasting may be used. If chemicals are used, they shall comply with the state's environmental protection regulations. Removal methods used shall not cause major damage to the pavement, or to any structure or utility within or adjacent to the work area. Major damage is defined as changing the properties of the pavement, removal of asphalt causing the aggregate to ravel, or removing pavement over 1/8 inch (3 mm) deep. If it is deemed by the Engineer 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 Engineer RPR.~~

~~Removal of foreign substances shall not proceed until approved by the Engineer 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 Engineer 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 sized appropriately for the depth of the patch. The material shall be compacted with equipment approved by the Engineer 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 Engineer 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 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 underlying surface. The milling machine or grinder shall be equipped with grade and slope controls, and a positive means of dust control. All millings shall be removed and disposed of off Airport property. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material removed with new material at the Contractor's expense.~~

~~**a. Patching.** The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth~~

of cut. The 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 7 feet and it shall be equipped with electronic grade control devices that will cut the surface to the grade specified. The tolerances shall be maintained within  $\pm 0$  inch and  $1/4$  inch ( $\pm 0$  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 windrow the millings or cuttings or remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of off the airport, unless incorporated into the embankment.

**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 of off Airport property.

**101-3.6. Preparation of asphalt pavement surfaces prior to surface treatment.** 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 Engineer 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 Engineer and 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 Engineer and 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 or random crack saw 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 Crack Sealant.** ~~Existing sealants will be removed by routing or random crack saw. Following routing or sawing 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-605.~~

#### **101-3.9.4 Removal of Pipe and other Buried Structures.**

**a. Removal of Existing Pipe Material.** Remove the types of pipe as indicated on the plans. The pipe material shall be legally disposed of off-site in a timely manner following removal. Trenches shall be backfilled with material equal to or better in quality than adjacent embankment. Trenches under paved areas must be compacted to 100% of ASTM D698.

**b. Removal of Inlets/Manholes.** Not Used

**c. Removal of Headwalls.** Where indicated on the plans or as directed by the Engineer, headwalls shall be removed and legally disposed of off-site in a timely fashion after removal. Excavations after removal shall be backfilled with material equal or better in quality than the adjacent embankment. Backfill must be compacted to 100% of ASTM D 698.

### **METHOD OF MEASUREMENT**

**101-4.1 Pavement removal.** 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. Dowel bar installation shall be incidental to pavement removal.

**101-4.2 Joint resealing.** The unit of measurement for joint resealing per paragraph 101-3.8 shall be the linear foot of joint.

**101-4.3 Removal of Pipe and other Buried Structures.** The unit of measurement for removal of pipe will be per linear foot. Removal of other buried structures will be per each. This price shall be full compensation for all labor, equipment, tools, and incidentals necessary to complete this item in accordance with paragraph 101-3.9.4.

### **BASIS OF PAYMENT**

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

Item P 101-5.1	Remove Concrete Pavement (<9" Thick) - per square yard
Item P 101-5.2	Remove Concrete Pavement (>9" Thick) – per square yard
Item P 101-5.3	Remove Hot Mix Asphalt Pavement – per square yard

Item P-101-5.4	Remove 18" RCP Headwall – per each
Item P-101-5.5	Remove 18" RCP – per linear foot
Item P-101-5.6	Remove 15" CMP – per linear foot
Item P-101-5.7	Reseal Existing Concrete Pavement Joints – 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 150/5380-6 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**



## **Summary of Modifications**

### **Item P-152 Excavation, Subgrade, and Embankment**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as Engineer RPR.

Revisions to include the use of Engineer or RPR may be shown throughout the document as Engineer and/or RPR.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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

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

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

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

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the Engineer and 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.

**152-2.8 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 Engineer RPR. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

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

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

The RPR ~~[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 ASTM D698. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the RPR ~~[Contractor]~~ for every 1,000 square yards of compacted embankment for each lift which is required to be compacted, or a minimum of three (3) tests per construction area, whichever is greater, for each lift of material placed.

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.

If nuclear density machines are to be used for density determination, the machines shall be calibrated in accordance with ASTM D6938.

Rolling operations shall be continued until the embankment is compacted to not less than 100% of maximum density for non-cohesive soils, and ~~95% of maximum density~~ as shown below for cohesive soils as determined by ASTM D698.

Sandy soils having a plasticity index (PI) of 15 or less shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content within three percentage points ( $\pm 3\%$ ) of the optimum moisture value. Sandy clay soils having a plasticity index (PI) between 16 and 25 shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one percentage point below to five percentage points above the optimum moisture value ( $-1\%$  to  $+5\%$ ). Clay soils having a plasticity index (PI) between 26 and 35 shall be compacted to between 95% and 100% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one to six percentage points above the optimum moisture value ( $+1\%$  to  $+6\%$ ). Clay soils having a plasticity index (PI) of 36 or more shall be compacted to between 93% and 98% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from three to eight percentage points above the optimum moisture value ( $+3\%$  to  $+8\%$ ). The recommended moisture content at the time of compaction and the density limits are listed below based on the plasticity index (PI) of the respective subgrade and/or fill soils. **Overcompaction shall not be allowed.**

152-2.8 - Compaction Table		
Plasticity Index (PI)	Moisture Content Range at Time of Compaction (%)	Percent Maximum Dry Density (%0
≤ 15	±3%	95% +
16 to 25	-1% to +5%	95% +
26 to 35	+1% to +6%	95% to 100%
≥ 36	+3% to +8%	93% to 98%

Under all areas to be paved, the embankments shall be compacted to a depth of in lifts no greater than 8 inches and to a density of not less than as shown above 100 percent of the maximum density as determined by ASTM D698. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches (100 mm) which shall be prepared for a seedbed in accordance with Item T-9044.

The in-place field density shall be determined in accordance with ~~[ASTM D1556]~~ 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 RPR shall perform all density tests. If the specified density is not attained, the area represented by the test or as designated by the Engineer 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 Engineer RPR and the finer material shall be used to fill the voids forming a dense, compact mass. Rock, cement concrete pavement, asphalt pavement, and other embankment material shall not be disposed of except at places and in the manner designated on the plans or by the Engineer RPR.

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

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

**152-2.9 Proof rolling.** ~~Proof rolling is not required on all projects.~~ The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. Before start of embankment and after compaction is completed, the subgrade area shall be proof rolled with a 20 ton Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to 100 psi, or other approved method, in the presence of the RPR. Apply a minimum of 95% coverage, or as specified by the Engineer RPR, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch (25 mm) or show permanent deformation greater than 1 inch (25 mm) shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

**152-2.10 Compaction requirements.** The subgrade under areas to be paved shall be compacted to a depth of 12 inches in conformance with the directions shown below, ~~and to a density of not less than 100 percent of the maximum dry density as determined by ASTM D698.~~ The subgrade in areas outside the limits of the pavement areas shall meet these same requirements ~~be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D698.~~

The material to be compacted shall be at the moisture content shown below ~~within  $\pm 2\%$  of optimum moisture content~~ before being rolled to obtain the prescribed compaction ~~(except for expansive soils).~~ When the material has greater than 30 percent retained on the  $\frac{3}{4}$  inch (19.0 mm) sieve, follow the methods in ASTM D698. Tests for moisture content and compaction will be taken at a minimum of 1000 S.Y. of subgrade. All quality assurance testing shall be done by the RPR.

Sandy soils having a plasticity index (PI) of 15 or less shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content within three percentage points (+3%) of the optimum moisture value. Sandy clay soils having a plasticity index (PI) between 16 and 25 shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one percentage point below to five percentage points above the optimum moisture value (-1% to +5%). Clay soils having a plasticity index (PI) between 26 and 35 shall be compacted to between 95% and 100% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one to six percentage points above the optimum moisture value (+1% to +6%). Clay soils having a plasticity index (PI) of 36 or more shall be compacted to between 93% and 98% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from three to eight percentage points above the optimum moisture value (+3% to +8%). The recommended moisture content at the time of compaction and the density limits are listed below based on the plasticity index (PI) of the respective subgrade and/or fill soils. **Overcompaction shall not be allowed.**

152-2.8 - Compaction Table		
Plasticity Index (PI)	Moisture Content Range at Time of Compaction (%)	Percent Maximum Dry Density (%0
≤ 15	±3%	95% +
16 to 25	-1% to +5%	95% +
26 to 35	+1% to +6%	95% to 100%
≥ 36	+3% to +8%	93% to 98%

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

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

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

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

**152-3.1** Measurement for payment specified by the cubic yard (cubic meter) was computed by the comparison of digital terrain model (DTM) surfaces for computation of neat line design quantities. No modification to the quantities will be made for differences between actual quantities and the Engineer's estimated quantities shown in plans. Quantities are plan quantities only.

**152-3.3** The quantity of "Undercut and Replace Unsuitable Subgrade to be paid for shall be the number of cubic yards of material excavated, as measured in its original position, as directed by the Engineer or his authorized representative in the field. Measurement shall be the actual volume measured, completed and accepted. No payment will be made for materials excavated and replaced without prior authorization of the Engineer or his authorized representative.

**152-4.2 For Undercut and Replace Unsuitable Subgrade, 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.**



## Item P-152 Excavation, Subgrade, and Embankment

### DESCRIPTION

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

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

**a. Unclassified excavation.** Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature.

**152-1.3 Unsuitable excavation.** Unsuitable material shall be disposed in designated waste areas as shown on the plans. Materials containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the Engineer RPR.

### CONSTRUCTION METHODS

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

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

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

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

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the Engineer and 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 Engineer RPR has obtained from the Contractor, the survey notes of the elevations and

measurements of the ground surface. The Contractor and Engineer RPR shall agree that the original ground lines shown on the original topographic mapping are accurate, or agree to any adjustments made to the original ground lines.

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

Existing grades on the design cross sections or DTM's, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM's. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within 0.1 foot (30 mm) of the stated elevations for ground surfaces, or within 0.04 foot (12 mm) for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered "no change". Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's verification identifies discrepancies in the topographic map, Contractor shall notify the Engineer RPR in writing at least two weeks before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM's. Disturbance of existing grade in any area shall constitute acceptance by the Contractor of the accuracy of the original elevations shown on the topographic map for that area.

All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the Engineer 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 Engineer 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 Engineer 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 Engineer 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 of off the airport. The cost is incidental to this item. This excavated material shall be paid for at the contract unit price per cubic yard for unclassified excavation. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in

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

**152-2.5 Preparation of cut areas or areas where existing pavement has been removed.** In those areas on which a subbase or base course is to be placed, the top 12 inches (300 mm) 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 D698. 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 Engineer and 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 Engineer and 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 Engineer 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 Engineer 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 Engineer RPR. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

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

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

The RPR ~~{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 ASTM D698. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the RPR ~~{Contractor}~~ for every 1,000 square yards of compacted embankment for each lift which is required to be compacted, or a minimum of three (3) tests per construction area, whichever is greater, for each lift of material placed.

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.

If nuclear density machines are to be used for density determination, the machines shall be calibrated in accordance with ASTM D6938.

Rolling operations shall be continued until the embankment is compacted to not less than 100% of maximum density for non-cohesive soils, and ~~95% of maximum density as shown below~~ for cohesive soils as determined by ASTM D698.

Sandy soils having a plasticity index (PI) of 15 or less shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content within three percentage points ( $\pm 3\%$ ) of the optimum moisture value. Sandy clay soils having a plasticity index (PI) between 16 and 25 shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one percentage point below to five percentage points above the optimum moisture value ( $-1\%$  to  $+5\%$ ). Clay soils having a plasticity index (PI) between 26 and 35 shall be compacted to between 95% and 100% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one to six percentage points above the optimum moisture value ( $+1\%$  to  $+6\%$ ). Clay soils having a plasticity index (PI) of 36 or more shall be compacted to between 93% and 98% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging

from three to eight percentage points above the optimum moisture value (+3% to +8%). The recommended moisture content at the time of compaction and the density limits are listed below based on the plasticity index (PI) of the respective subgrade and/or fill soils. **Overcompaction shall not be allowed.**

152-2.8 - Compaction Table		
Plasticity Index (PI)	Moisture Content Range at Time of Compaction (%)	Percent Maximum Dry Density (%)
≤ 15	±3%	95% +
16 to 25	-1% to +5%	95% +
26 to 35	+1% to +6%	95% to 100%
≥ 36	+3% to +8%	93% to 98%

Under all areas to be paved, the embankments shall be compacted to a depth of in lifts no greater than 8 inches and to a density of not less than as shown above 100 percent of the maximum density as determined by ASTM D698. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches (100 mm) which shall be prepared for a seedbed in accordance with Item T-9044.

The in-place field density shall be determined in accordance with ~~ASTM D1556~~ 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 RPR shall perform all density tests. If the specified density is not attained, the area represented by the test or as designated by the Engineer 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 Engineer RPR and the finer material shall be used to fill the voids forming a dense, compact mass. Rock, cement concrete pavement, asphalt pavement, and other embankment material shall not be disposed of except at places and in the manner designated on the plans or by the Engineer RPR.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in lifts of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in lifts not exceeding 2 feet (60 cm) in

thickness. Each lift shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The lift shall not be constructed above an elevation 4 feet (1.2 m) below the finished subgrade.

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

**152-2.9 Proof rolling.** ~~Proof rolling is not required on all projects.~~ The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. Before start of embankment and after compaction is completed, the subgrade area shall be proof rolled with a 20 ton Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to 100 psi, or other approved method, in the presence of the RPR. Apply a minimum of 95% coverage, or as specified by the Engineer RPR, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch (25 mm) or show permanent deformation greater than 1 inch (25 mm) shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

**152-2.10 Compaction requirements.** The subgrade under areas to be paved shall be compacted to a depth of 12 inches in conformance with the directions shown below, ~~and to a density of not less than 100 percent of the maximum dry density as determined by ASTM D698.~~ The subgrade in areas outside the limits of the pavement areas shall meet these same requirements ~~be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D698.~~

The material to be compacted shall be at the moisture content shown below ~~within  $\pm 2\%$  of optimum moisture content~~ before being rolled to obtain the prescribed compaction (~~except for expansive soils~~). When the material has greater than 30 percent retained on the  $\frac{3}{4}$  inch (19.0 mm) sieve, follow the methods in ASTM D698. Tests for moisture content and compaction will be taken at a minimum of 1000 S.Y. of subgrade. All quality assurance testing shall be done by the RPR.

Sandy soils having a plasticity index (PI) of 15 or less shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content within three percentage points (+3%) of the optimum moisture value. Sandy clay soils having a plasticity index (PI) between 16 and 25 shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one percentage point below to five percentage points above the optimum moisture value (-1% to +5%). Clay soils having a plasticity index (PI) between 26 and 35 shall be compacted to between 95% and 100% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one to six percentage points above the optimum moisture value (+1% to +6%). Clay soils having a plasticity index (PI) of 36 or more shall be compacted to between 93% and 98% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from three to eight percentage points above the optimum moisture value (+3% to +8%). The recommended moisture content at the time of compaction and the density limits are listed below based on the plasticity index (PI) of the respective subgrade and/or fill soils. **Overcompaction shall not be allowed.**

152-2.8 - Compaction Table		
Plasticity Index (PI)	Moisture Content Range at Time of Compaction (%)	Percent Maximum Dry Density (%0)
$\leq 15$	$\pm 3\%$	95% +

16 to 25	-1% to +5%	95% +
26 to 35	+1% to +6%	95% to 100%
≥ 36	+3% to +8%	93% to 98%

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

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

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

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

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

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

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

**152-2.13 Surface Tolerances.** In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the Engineer ~~RPR~~. The Contractor shall perform all final smoothness and grade checks in the presence of the Engineer and ~~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 be placed, grade shall not vary more than 0.10 feet (30 mm) from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

**152-2.14 Topsoil.** When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP, and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the Engineer 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 and as required in Item T-905. Topsoil shall be paid for as provided in Item T-905. No direct payment will be made for topsoil under Item P-152.

### METHOD OF MEASUREMENT

**152-3.1** Measurement for payment specified by the cubic yard (cubic meter) was computed by the comparison of digital terrain model (DTM) surfaces for computation of neat line design quantities. No modification to the quantities will be made for differences between actual quantities and the Engineer's estimated quantities shown in plans. Quantities are plan quantities only.

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

**152-3.3** The quantity of "Undercut and Replace Unsuitable Subgrade to be paid for shall be the number of cubic yards of material excavated, as measured in its original position, as directed by the Engineer or his authorized representative in the field. Measurement shall be the actual volume measured, completed and accepted. No payment will be made for materials excavated and replaced without prior authorization of the Engineer or his authorized representative.

### BASIS OF PAYMENT

**152-4.1** Unclassified excavation payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

**152-4.2** For Undercut and Replace Unsuitable Subgrade, 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:

Item P-152-4.1	Unclassified Excavation – per cubic yard
Item P-152-4.2	Undercut and Replace Unsuitable Subgrade – 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<sup>3</sup> (600 kN-m/m<sup>3</sup>))

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<sup>3</sup> (2700 kN-m/m<sup>3</sup>))

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**

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## Item P-153 Controlled Low-Strength Material (CLSM)

### DESCRIPTION

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

### MATERIALS

#### 153-2.1 Materials.

- a. Cement.** Cement shall conform to the requirements of ASTM C150 Type I, II, or V.
- b. Fly ash.** Fly ash shall conform to ASTM C618, Class C or F.
- c. Fine aggregate (sand).** Fine aggregate shall conform to the requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces the specified performance characteristics of the CLSM and meets the following requirements, will be accepted.

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

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

### MIX DESIGN

**153-3.1 Proportions.** The Contractor shall submit, to the ~~Engineer RPR~~, a mix design including the proportions and source of aggregate, fly ash, cement, water, and approved admixtures. No CLSM mixture shall be produced for payment until the ~~Engineer 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 Engineer ~~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 Engineer and ~~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 Engineer and/or ~~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 Engineer ~~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 Engineer and ~~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**

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## 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 <sup>1</sup> (Percent)
	Subbase Aggregate		
3 inch (75 mm)	100		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)	0-15		±5

<sup>1</sup> 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 **Engineer 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.

**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 **Engineer** and RPR by the Contractor each day during construction. Material shall meet the requirements in paragraph 154-2.1.

**154-2.3 Separation Geotextile.** Not used.

**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 **Engineer 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 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 **Engineer** and 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 **Engineer** and 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 **Engineer 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 Engineer 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 Engineer 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  $\pm 2\%$  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-compact 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 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-compact to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

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

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

**154-3.9 Acceptance sampling and testing.** The aggregate base course shall be accepted for density and thickness on an area basis. Two test shall be made for density and thickness for each 1200 square yards. Sampling locations will be determined on a random basis per ASTM D3665.

**a. Density.** The RPR shall perform all density tests.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test 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.

**a. 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.

## METHOD OF MEASUREMENT

**154-4.1** Subbase course shall be measured by the number of square 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. 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 square 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:

Item P-154-5.1	6" Subbase Course - per square yard
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## 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- $\mu\text{m}$ (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 <sup>3</sup> (600 kN-m/m <sup>3</sup> ))
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 <sup>3</sup> (2,700 kN-m/m <sup>3</sup> ))
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
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**END OF ITEM P-154**

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## Summary of Modifications

### Item P-155 Lime-Treated Subgrade

This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as Engineer ~~RPR~~.

Revisions to include the use of Engineer or RPR may be shown throughout the document as Engineer and/or ~~RPR~~.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

**155-3.2 Tolerances.** At final compaction, the lime and water content for each course of subgrade treatment shall conform to the following tolerances:

#### Tolerances

Material	Tolerance
Lime	+ 0.5%
Water	<del>+ 2%, - 0%</del> -3% to +3%

**155-6.2 Application.** Dry placement of lime will not be allowed. Lime shall be uniformly spread only over an area where the initial mixing operations can be completed during the same work day. Lime shall not be applied when wind conditions are detrimental to proper application. A motor grader shall not be used to spread the lime. Adequate moisture shall be added to the cement/soil mixture to maintain the proper moisture content. Materials shall be handled, stored, and applied in accordance with all federal, state, and local requirements.

**155-6.7 Finishing and curing.** After the final lift or course of lime-treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling, as directed by the RPR, with a pneumatic or other suitable roller sufficiently light to prevent hairline cracking. The finished surface shall not vary more than 1/2-inch (12 mm) when tested with a 12-foot (3.7 m) straightedge applied parallel with and at right angles to the pavement centerline. Any variations in excess of this tolerance shall be corrected by the Contractor at the Contractor's expense in a manner satisfactory to the Engineer ~~RPR~~.

The completed section shall be moist-cured for a minimum of seven (7) days before further courses are added or any traffic is permitted, unless otherwise directed by the Engineer ~~RPR~~. The final lift should not be exposed for more than 14 days without protection or the placement of a base course material. If surface is to be left exposed more than 14 days, a prime coat shall be placed on the lime treated subgrade by the contractor at no cost to the Owner.

**155-7.2** Lime shall be paid by the number of tons (kg) of Hydrated Lime applied at the application rate specified in paragraph 155-3.1.

a. Hydrated lime delivered to the project in dry form will be measured according to the actual tonnage ~~either spread on the subgrade or batched on site into a slurry, whichever is applicable.~~

b. Quicklime delivered to the project in dry form will be measured for payment on the basis of the tons of equivalent hydrated lime using the following formula:

$$\text{Equivalent Hydrated Lime (Ca(OH)}_2\text{)} = \text{Total Quicklime (CaO)} \times 1.32$$

c. Lime delivered to the project in slurry form will be measured for payment in tons, dry weight of hydrated lime or equivalent hydrated lime in accordance with paragraph b above.

## Item P-155 Lime-Treated Subgrade

### DESCRIPTION

**155-1.1** This item shall be used for soil modification that require strength gain to a specific level. This item shall consist of constructing one or more courses of a mixture of soil, lime, and water in accordance with this specification, and in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans.

### MATERIALS

**155-2.1 Lime.** Quicklime, hydrated lime, and either high-calcium dolomitic, or magnesium lime, as defined by ASTM C51, shall conform to the requirements of ASTM C977. Lime not produced from calcining limestone is not permitted.

**155-2.2 Commercial lime slurry.** Commercial lime slurry shall be a pumpable suspension of solids in water. The water or liquid portion of the slurry shall not contain dissolved material injurious or objectionable for the intended purpose. The solids portion of the mixture, when considered on the basis of “solids content,” shall consist principally of hydrated lime of a quality and fineness sufficient to meet the following chemical composition and residue requirements.

**a. Chemical composition.** The “solids content” of the lime slurry shall consist of a minimum of 70%, by weight, of calcium and magnesium oxides.

**b. Residue.** The percent by weight of residue retained in the “solids content” of lime slurry shall conform to the following requirements:

- Residue retained on a No. 6 (3.35  $\mu\text{m}$ ) sieve = maximum 0.0%
- Residue retained on a No. 10 (2.00  $\mu\text{m}$ ) sieve = maximum 1.0%
- Residue retained on a No. 30 (600  $\mu\text{m}$ ) sieve = maximum 2.5%

**c. Grade.** Commercial lime slurry shall conform to one of the following two grades:

- Grade 1. The “dry solids content” shall be at least 31% by weight, of the slurry.
- Grade 2. The “dry solids content” shall be at least 35%, by weight, of the slurry.

**155-2.3 Water.** Water used in mixing or curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

**155-2.4 Soil.** The soil for this work shall consist of on-site materials free of roots, sod, weeds, and stones larger than 2-1/2 inches (60 mm) and have a sulfate content of less than 0.3%.

### COMPOSITION

**155-3.1 Soil-lime mixture.** Lime shall be applied at 8% dry unit weight of soil for the depth of subgrade treatment as shown on the plans.

**155-3.2 Tolerances.** At final compaction, the lime and water content for each course of subgrade treatment shall conform to the following tolerances:

#### Tolerances

Material	Tolerance
Lime	+ 0.5%
Water	+2%, -0% -3% to +3%

#### WEATHER LIMITATIONS

**155-4.1 Weather limitation.** Subgrade shall not be constructed when weather conditions detrimentally affect the quality of the materials. Lime shall not be applied unless the air temperature is at least 40°F (4°C) and rising. Lime shall not be applied to soils that are frozen or contain frost. Protect completed lime-treated areas by approved methods against the detrimental effects of freezing if the air temperature falls below 35°F (2°C). Remove and replace any damaged portion of the completed soil-lime treated area with new soil-lime material in accordance with this specification.

#### EQUIPMENT

**155-5.1 Equipment.** All equipment necessary to grade, scarify, spread, mix and compact the material shall be provided. The Resident Project Representative (RPR) must approve the Contractor's proposed equipment prior to the start of the treatment.

#### CONSTRUCTION METHODS

**155-6.1 General.** This specification is to construct a subgrade consisting of a uniform lime mixture which shall be free from loose or segregated areas. The subgrade shall be of uniform density and moisture content, well mixed for its full depth, and have a smooth surface suitable for placing subsequent lifts. The Contractor shall be responsible to meet the above requirements.

Prior to any treatment, the subgrade shall be constructed as specified in Item P-152, Excavation, Subgrade and Embankment, and shaped to conform to the typical sections, lines, and grades as shown on the plans.

The mixing equipment must give visible indication at all times that it is cutting, pulverizing and mixing the material uniformly to the proper depth over the full width of the cut.

**155-6.2 Application.** Dry placement of lime will not be allowed. Lime shall be uniformly spread only over an area where the initial mixing operations can be completed during the same work day. Lime shall not be applied when wind conditions are detrimental to proper application. A motor grader shall not be used to spread the lime. Adequate moisture shall be added to the cement/soil mixture to maintain the proper moisture content. Materials shall be handled, stored, and applied in accordance with all federal, state, and local requirements.

**155-6.3 Mixing.** The mixing procedure shall be as described below:

**a. Preliminary mixing.** The full depth of the treated subgrade shall be mixed with an approved mixing machine. Lime shall not be left exposed for more than six (6) hours. The mixing machine shall make two coverages. Water shall be added to the subgrade during mixing to provide a moisture content approximately 3% to 5% above the optimum moisture of the material and to ensure chemical reaction of

the lime and subgrade. After mixing, the subgrade shall be lightly rolled to seal the surface and help prevent evaporation of moisture. The water content of the subgrade mixture shall be maintained at a moisture content above the optimum moisture content for a minimum of 4 to 24 hours or until the material becomes friable. During the mellowing period, the material shall be sprinkled as directed by the RPR.

**b. Final mixing.** After the required mellowing time, the material shall be uniformly mixed by approved methods. Any clods shall be reduced in size by blading, discing, harrowing, scarifying, or by the use of other approved pulverization methods. After curing, pulverize lime treated material until 100% of soil particles pass a one-inch (25.0 mm) sieve and 60% pass the No. 4 (4.75 mm) sieve when tested dry by laboratory sieves. If resultant mixture contains clods, reduce their size by scarifying, remixing, or pulverization to meet specified gradation.

**155-6.4 Control Strip.** The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the Engineer and RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the RPR. Upon acceptance of the control strip by the RPR, the Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the Engineer RPR.

**155-6.5 Treatment Application and Depth Checks.** The depth and amount of stabilization shall be measured by the Contractor with no less than 2 tests per day of material placed; test shall be witnessed by the RPR. Measurements shall be made in test holes excavated to show the full depth of mixing and the pH checked by spraying the side of the test hole with a pH indicator such as phenolphthalein. Phenolphthalein changes from clear to red between pH 8.3 and 10. The color change indicates the location of the bottom of the mixing zone. pH indicators other than phenolphthalein can be used to measure pH levels. If the pH is not at least 8.3 and/or if the depth of the treated subgrade is more than 1/2 inch (12 mm) deficient, additional lime treatment shall be added and the material remixed. The Contractor shall correct all such areas in a manner satisfactory to the Engineer RPR.

**155-6.6 Compaction.** Compaction of the mixture shall immediately follow the final mixing operation with the mixture compacted within 1 to 4 hours after final mixing. The material shall be at the moisture content specified in paragraph 155-3.2 during compaction. The field density of the compacted mixture shall be at least 95% of the maximum density as specified in paragraph 155-6.10. Perform in-place density test to determine degree of compaction between 24 and 72 hours after final compaction and the 24-hour moist cure period. If the material fails to meet the density requirements, it shall be reworked to meet the density requirements. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

**155-6.7 Finishing and curing.** After the final lift or course of lime-treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling, as directed by the RPR, with a pneumatic or other suitable roller sufficiently light to prevent hairline cracking. The finished surface shall not vary more than 1/2-inch (12 mm) when tested with a 12-foot (3.7 m) straightedge applied parallel with and at right angles to the pavement centerline. Any variations in excess of this tolerance shall be corrected by the Contractor at the Contractor's expense in a manner satisfactory to the Engineer RPR.

The completed section shall be moist-cured for a minimum of seven (7) days before further courses are added or any traffic is permitted, unless otherwise directed by the Engineer RPR. The final lift should not be exposed for more than 14 days without protection or the placement of a base course material. If surface is to be left exposed more than 14 days, a prime coat shall be placed on the lime treated subgrade by the contractor at no cost to the Owner.

**155-6.8 Maintenance.** The Contractor shall protect and maintain the lime-treated subgrade from yielding until the lime-treated subgrade is covered by placement of the next lift. 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 meets all specification requirements. The maintenance cost shall be incidental to this item.

**155-6.9 Surface tolerance.** In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

**a. Smoothness.** The finished surface shall not vary more than +/- 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.

**155-6.10 Acceptance sampling and testing.** The lime treated subgrade shall be accepted for density and thickness on an area basis. Testing frequency shall be a minimum of one compaction and thickness test per 1000 square yards of lime treated subgrade, but not less than four (4) tests per day of production. Sampling locations will be determined on a random basis per ASTM D3665.

**a. Density.** All testing shall be done by RPR.

The field density of the compacted mixture shall be at least 95% of the maximum density of laboratory specimens prepared from samples taken from the material in place. The specimens shall be compacted and tested in accordance with ASTM D698 to determine maximum density and optimum moisture content. The in-place field density shall be determined in accordance with ASTM D6938, Procedure A, direct transmission method. If the material fails to meet the density requirements, the area represented by the failed test shall be reworked to meet the density requirements. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

**b. Thickness.** The thickness of the 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. The Contractor shall replace, at his expense, material where depth tests have been taken.

**155-6.11 Handling and safety.** The Contractor shall obtain and enforce the lime supplier's instructions for proper safety and handling of the lime to prevent physical eye or skin contact with lime during transport or application.

## METHOD OF MEASUREMENT

**155-7.1** Lime-treated subgrade shall be paid for by the square yard (square meter) in the completed and accepted work.

**155-7.2** Lime shall be paid by the number of tons (kg) of Hydrated Lime applied at the application rate specified in paragraph 155-3.1.

a. Hydrated lime delivered to the project in dry form will be measured according to the actual tonnage ~~either spread on the subgrade or batched on site into a slurry, whichever is applicable.~~

b. Quicklime delivered to the project in dry form will be measured for payment on the basis of the tons of equivalent hydrated lime using the following formula:

$$\text{Equivalent Hydrated Lime (Ca(OH)}_2\text{)} = \text{Total Quicklime (CaO)} \times 1.32$$

c. Lime delivered to the project in slurry form will be measured for payment in tons, dry weight of hydrated lime or equivalent hydrated lime in accordance with paragraph b above.

### BASIS OF PAYMENT

**155-8.1** Payment shall be made at the contract unit price per square yard (square meter) for the lime-treated subgrade at the thickness specified. The price shall be full compensation for furnishing all material, except the lime, and for all preparation, delivering, placing and mixing these materials, and all labor, equipment, tools and incidentals necessary to complete this item.

**155-8.2** Payment shall be made at the contract unit price per ton (kg). This price shall be full compensation for furnishing, delivery, and placing this material.

Payment will be made under:

Item P-155-8.1	8" Lime-treated subgrade - per square yard
Item P-155-8.2	Lime - 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 C51	Standard Terminology Relating to Lime and Limestone (as used by the Industry)
ASTM C977	Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> ) (600 kN-m/m <sup>3</sup> )
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

#### Software

FAARFIELD –	FAA Rigid and Flexible Iterative Elastic Layered Design
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**END OF ITEM P-155**

## **Summary of Modifications**

### **Item P-501 Cement Concrete Pavement**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as **Engineer RPR**.

Revisions to include the use of Engineer or RPR may be shown throughout the document as **Engineer** and/or **RPR**.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**501-4.12 Surface texture.** The surface of the pavement shall be finished as designated below for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. The texture shall be uniform in appearance and approximately 1/16 inch (2 mm) in depth. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the RPR.

**a. Brush or broom finish.** Shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface.

**b. Burlap drag finish.** ~~Burlap, at least 15 ounces per square yard (555 grams per square meter), will typically produce acceptable texture. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately one foot (30 cm) from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface.~~

**e. Artificial turf finish.** ~~Shall be applied by dragging the surface of the pavement in the direction of concrete placement with an approved full width drag made with artificial turf. The leading transverse edge of the artificial turf drag will be securely fastened to a lightweight pole on a traveling bridge. At least 2 feet (60 cm) of the artificial turf shall be in contact with the concrete surface during dragging operations. Approval of the artificial turf will be done only after it has been demonstrated by the Contractor to provide a satisfactory texture. One type that has provided satisfactory texture consists of 7,200 approximately 0.85-inch long polyethylene turf blades per square foot.~~

**501-4.13 Curing.** Immediately after finishing operations are completed and bleed water is gone from the surface, all exposed surfaces of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-saw-cut method is used to construct the contraction joint, the curing compound shall be applied to the saw-cut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

**a. Impervious membrane method.** Curing with liquid membrane compounds should not occur until bleed and surface moisture has evaporated. All exposed surfaces of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of one gallon (4 liters) to not more than 150 square feet (14 sq m). The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the RPR, a double application rate shall be used to ensure coverage. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

~~**b. White burlap polyethylene sheets.** The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for seven (7) days after the concrete has been placed.~~

~~**c. Water method.** The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.~~

**d. Concrete protection for cold weather.** Maintain the concrete at a temperature of at least 50°F (10°C) for a period of 72 hours after placing and at a temperature above freezing for the remainder of the 7-day curing period. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged shall be removed and replaced at the Contractor's expense.

**e. Concrete protection for hot weather.** Concrete should be continuous moisture cured for the entire curing period and shall commence as soon as the surfaces are finished and continue for at least 24 hours. However, if moisture curing is not practical beyond 24 hours, the concrete surface shall be protected from drying with application of a liquid membrane-forming curing compound while the surfaces are still damp. Other curing methods may be approved by the RPR.

## Item P-501 Cement Concrete Pavement

### DESCRIPTION

**501-1.1** This work shall consist of pavement composed of cement concrete with and without reinforcement constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross-sections shown on the plans. The terms cement concrete, hydraulic cement concrete, and concrete are interchangeable in this specification.

### MATERIALS

#### 501-2.1 Aggregates.

**a. Reactivity.** Fine and Coarse aggregates to be used in PCC on this project shall be tested and evaluated by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and ASTM C1567. Tests must be representative of aggregate sources which will be providing material for production. ASTM C1260 and ASTM C1567 tests may be run concurrently.

(1) Coarse aggregate and fine aggregate shall be tested separately in accordance with ASTM C1260, however, the length of test shall be extended to 28 days (30 days from casting). Tests must have been completed within 6 months of the date of the concrete mix submittal.

(2) The combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

(3) If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) Concrete Research Division (CRD) C662 in lieu of ASTM C1567. If lithium nitrate admixture is used, it shall be nominal 30%  $\pm$ 0.5% weight lithium nitrate in water. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

**b. Fine aggregate.** Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C33 and the parameters identified in the fine aggregate material requirements below. Fine aggregate material requirements and deleterious limits are shown in the table below.

<b>Fine Aggregate Material Requirements</b>		
Soundness of Aggregates by Use of Sodium Sulfate <b>or</b> Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Sand Equivalent	45 minimum	ASTM D2419
Fineness Modulus (FM)	$2.50 \leq FM \leq 3.40$	ASTM C136
<b>Limits for Deleterious Substances in Fine Aggregate for Concrete</b>		
Clay lumps and friable particles	1.0% maximum	ASTM C142
Coal and lignite	0.5% using a medium with a density of Sp. Gr. of 2.0	ASTM C123

**c. Coarse aggregate.** The maximum size coarse aggregate shall be 1 1/2-inch.

Aggregates delivered to the mixer shall be clean, hard, uncoated aggregates consisting of crushed stone, crushed or uncrushed gravel, air-cooled iron blast furnace slag, crushed recycled concrete pavement, or a combination. The aggregates shall have no known history of detrimental pavement staining. Steel blast furnace slag shall not be permitted. Coarse aggregate material requirements and deleterious limits are shown in the table below; washing may be required to meet aggregate requirements.

#### **Coarse Aggregate Material Requirements**

<b>Material Test</b>	<b>Requirement</b>	<b>Standard</b>
Resistance to Degradation	Loss: 40% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate <b>or</b> Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 for any size group coarser than 3/8 (9.5 mm) sieve <sup>1</sup>	ASTM D4791
Bulk density of slag <sup>2</sup>	Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)	ASTM C29

<sup>1</sup> 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).

<sup>2</sup> Only required if slag is specified.

The amount of deleterious material in the coarse aggregate shall not exceed the following limits:

### Limits for Deleterious Substances in Coarse Aggregate

Deleterious material	ASTM	Percentage by Mass
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than No. 200 sieve (75 μm)	ASTM C117	1.0 <sup>1</sup>
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Chert <sup>2</sup> (less than 2.40 Sp Gr.)	ASTM C123 using a medium with a density of Sp. Gr. of 2.40)	

<sup>1</sup> The limit for material finer than 75-μm is allowed to be increased to 1.5% for crushed aggregates consisting of dust of fracture that is essentially free from clay or shale. Test results supporting acceptance of increasing limit to 1.5% with statement indicating material is dust of fracture must be submitted with Concrete mix. Acceptable techniques to characterizing these fines include methylene blue adsorption or X-ray diffraction analysis.

<sup>2</sup> Chert and aggregates with less than 2.4 specific gravity.

<sup>3</sup> The limit for chert may be increased to 1.0 percent by mass in areas not subject to severe freeze and thaw.

**d. Combined aggregate gradation.** This specification is targeted for a combined aggregate gradation developed following the guidance presented in United States Air Force Engineering Technical Letter (ETL) 97-5: Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements. Base the aggregate grading upon a combination of all the aggregates (coarse and fine) to be used for the mixture proportioning. Three aggregate sizes may be required to achieve an optimized combined gradation that will produce a workable concrete mixture for its intended use. Use aggregate gradations that produce concrete mixtures with well-graded or optimized aggregate combinations. The Contractor shall submit complete mixture information necessary to calculate the volumetric components of the mixture. The combined aggregate grading shall meet the following requirements:

(1) The materials selected and the proportions used shall be such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in paragraph 501-2.1d(4) below, the point thus determined shall fall within the parallelogram described therein.

(2) The CF shall be determined from the following equation:

$$CF = \frac{\text{(cumulative percent retained on the 3/8 in. (9.5 mm) sieve)}(100)}{\text{(cumulative percent retained on the No. 8 (2.36 mm) sieve)}}$$

(3) The WF is defined as the percent passing the No. 8 (2.36 mm) sieve based on the combined gradation. However, WF shall be adjusted, upwards only, by 2.5 percentage points for each 94 pounds (42 kg) of cementitious material per cubic meter yard greater than 564 pounds per cubic yard (335 kg per cubic meter).

(4) A diagram shall be plotted using a rectangular scale with WF on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram a parallelogram shall be plotted with corners at the following coordinates (CF-75, WF-28), (CF-75, WF-40), (CF-45, WF-32.5), and (CF-45, WF-44.5). If the point determined by the intersection of the computed CF and WF does not fall within the above parallelogram, the grading of each size of aggregate used and the proportions selected shall be changed as necessary. The point determined by the plotting of the CF and WF may be adjusted during production  $\pm 3$  WF and  $\pm 5$  CF. Adjustments to gradation may not take the point outside of the parallelogram.

**e. Contractors combined aggregate gradation.** The Contractor shall submit their combined aggregate gradation using the following format:

### Contractor's Combined Aggregate Gradation

Sieve Size	Contractor's Concrete mix Gradation (Percent passing by weight)
2 inch (50 mm)	*
1-1/2 inch (37.5 mm)	*
1 inch (25.0 mm)	*
3/4 inch (19.0 mm)	*
1/2 inch (12.5 mm)	*
3/8 inch (9.5 mm)	*
No. 4 (4.75 mm)	*
No. 8 (2.36 mm)	*
No. 16 (1.18 mm)	*
No. 30 (600 $\mu$ m)	*
No. 50 (300 $\mu$ m)	*
No. 100 (150 $\mu$ m)	*

Reference United States Air Force Engineering Technical Letter (ETL) 97-5: Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements. The ETL is available at the following website:

<http://wbdg.org/ffc/af-afcec/engineering-technical-letters-afetl/etl-97-5>

**501-2.2 Cement.** Cement shall conform to the requirements of ASTM C150 Type I, II, or V.

**501-2.3 Cementitious materials.**

**a. Fly ash.** Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total alkali content less than 3% per ASTM C311. 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 Resident Project Representative (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.

**c. Raw or calcined natural pozzolan.** Natural pozzolan shall be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and shall have a loss on ignition not exceeding 6%. Class N pozzolan for use in mitigating Alkali-Silica Reactivity shall have a total available alkali content less than 3%.

**d. Ultrafine fly ash and ultrafine pozzolan.** UltraFine Fly Ash (UFFA) and UltraFine Pozzolan (UFP) shall conform to ASTM C618, Class F or N, and the following additional requirements:

- (1) The strength activity index at 28 days of age shall be at least 95% of the control specimens.
- (2) The average particle size shall not exceed 6 microns.

**501-2.4 Joint seal.** The joint seal for the joints in the concrete pavement shall meet the requirements of Item P-605 and shall be of the type specified in the plans.

**501-2.5 Isolation joint filler.** Premolded joint filler for isolation joints shall conform to the requirements of ASTM D1751 or ASTM D1752 and shall be where shown on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the RPR. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the RPR.

**501-2.6 Steel reinforcement.** Reinforcing shall consist of deformed bars conforming to the requirements of ASTM A615.

**501-2.7 Dowel and tie bars.** Dowel bars shall be plain steel bars conforming to ASTM A615 and shall be free from burring or other deformation restricting slippage in the concrete.

**a. Dowel Bars.** Before delivery to the construction site each dowel bar shall be epoxy coated per ASTM A1078, Type 1, with a coating thickness after curing greater than 10 mils. Patched ends are not required for Type 1 coated dowels. The dowels shall be coated with a bond-breaker recommended by the manufacturer. Dowel sleeves or inserts are not permitted. Grout retention rings shall be fully circular metal or plastic devices capable of supporting the dowel until the grout hardens.

**b. Tie Bars.** Tie bars shall be deformed steel bars and conform to the requirements of ASTM A615. Tie bars designated as Grade 60 in ASTM A615 or ASTM A706 shall be used for construction requiring bent bars.

**501-2.8 Water.** Water used in mixing or curing shall be potable. If water is taken from other sources considered non-potable, it shall meet the requirements of ASTM C1602.

**501-2.9 Material for curing concrete.** Curing materials shall conform to one of the following specifications:

- a.** Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C309, Type 2, Class A, or Class B.
- b.** White polyethylene film for curing concrete shall conform to the requirements of ASTM C171.
- c.** White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C171.
- d.** Waterproof paper for curing concrete shall conform to the requirements of ASTM C171.

**501-2.10 Admixtures.** Admixtures shall conform to the following specifications:

**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-entraining 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.

**c. Other admixtures.** The use of set retarding and set-accelerating admixtures shall be approved by the RPR prior to developing the concrete mix. Retarding admixtures shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating admixtures shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

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

#### Lithium Admixture

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

The lithium nitrate admixture dispensing and mixing operations shall be verified and certified by the lithium manufacturer's representative.

**501-2.11 Epoxy-resin.** All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

- a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.
- b. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
- c. Material for use for injecting cracks shall be Type IV, Grade 1.
- d. Material for bonding freshly mixed Portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

**501-2.12 Bond Breaker.** Not required.

### CONCRETE MIX

**501-3.1. General.** No concrete shall be placed until an acceptable concrete mix has been submitted to the RPR for review and the RPR has taken appropriate action. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

**501-3.2 Concrete Mix Laboratory.** The laboratory used to develop the concrete mix shall be accredited in accordance with ASTM C1077. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for developing the concrete mix must be included in the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

**501-3.3 Concrete Mix Proportions.** Develop the mix using the procedures contained in Portland Cement Association (PCA) publication, "Design and Control of Concrete Mixtures." Concrete shall be proportioned to achieve a 28-day flexural strength that meets or exceeds the acceptance criteria contained in paragraph 501-6.6 for a flexural strength of 620 psi per ASTM C78.

The minimum cementitious material shall be adequate to ensure a workable, durable mix. The minimum cementitious material (cement plus fly ash, or slag cement) shall be 470 pounds per cubic yard. The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall be between 0.38 – 0.45 by weight.

Flexural strength test specimens shall be prepared in accordance with ASTM C192 and tested in accordance with ASTM C78. At the start of the project, the Contractor shall determine an allowable slump as determined by ASTM C143 not to exceed 2 inches (50 mm) for slip-form placement. For fixed-form placement, the slump shall not exceed 3 inches (75 mm). For hand placement, the slump shall not exceed 4 inches (100 mm).

The results of the concrete mix shall include a statement giving the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard (meter) basis. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

If a change in source(s) is made, or admixtures added or deleted from the mix, a new concrete mix must be submitted to the RPR for approval.

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.

**501-3.4 Concrete Mix submittal.** The concrete mix shall be submitted to the RPR at least 30 days prior to the start of operations. The submitted concrete mix shall not be more than 180 days old and must use the materials to be used for production for the project. Production shall not begin until the concrete mix is approved in writing by the RPR.

Each of the submitted concrete mixes (i.e, slip form, side form machine finish and side form hand finish) shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items and quantities as a minimum:

- Certified material test reports for aggregate in accordance with paragraph 501-2.1. Certified reports must include all tests required; reporting each test, test method, test result, and requirement specified (criteria).
- Combined aggregate gradations and analysis; and including plots of the fine aggregate fineness modulus.
- Reactivity Test Results.
- Coarse aggregate quality test results, including deleterious materials.
- Fine aggregate quality test results, including deleterious materials.
- Mill certificates for cement and supplemental cementitious materials.
- Certified test results for all admixtures, including Lithium Nitrate if applicable.
- Specified flexural strength, slump, and air content.
- Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.
- Flexural and compressive strength summaries and plots, including all individual beam and cylinder breaks.
- Correlation ratios for acceptance testing and Contractor QC testing, when applicable.
- Historical record of test results documenting production standard deviation, when applicable.

**501-3.5 Cementitious materials.**

**a. Fly ash.** When fly ash is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If fly ash is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

**b. Slag cement (ground granulated blast furnace (GGBF)).** Slag cement may be used. The slag cement, or slag cement plus fly ash if both are used, may constitute between 25 to 55% of the total cementitious material by weight.

**c. Raw or calcined natural pozzolan.** Natural pozzolan may be used in the concrete mix. When pozzolan is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If pozzolan is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

**d. Ultrafine fly ash (UFFA) and ultrafine pozzolan (UFP).** UFFA and UFP may be used in the concrete mix with the Engineer's RPR's approval. When UFFA and UFP is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 7% and 16% by weight of the total cementitious material.

### 501-3.6 Admixtures.

**a. Air-entraining admixtures.** Air-entraining admixture are to be added in such a manner that will ensure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air in the mix shall be 4.5%. Air content shall be determined by testing in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag and other highly porous coarse aggregate.

**b. Water-reducing admixtures.** Water-reducing admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

**c. Other admixtures.** Set controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

**d. Lithium nitrate.** Lithium nitrate shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements in accordance with paragraph 501-2.10d.

## CONSTRUCTION METHODS

**501-4.1 Control Strip.** The control strip(s) shall be to the next planned joint after the initial 250 feet (75 m) of each type of pavement construction (slip-form pilot lane, slip-form fill-in lane, or fixed form). The Contractor shall demonstrate, in the presence of the RPR, that the materials, concrete mix, equipment, construction processes, and quality control processes meet the requirements of the specifications. The concrete mixture shall be extruded from the paver meeting the edge slump tolerance and with little or no finishing. Pilot, fill-in, and fixed-form control strips will be accepted separately. Minor adjustments to the mix design may be required to place an acceptable control strip. The production mix will be the adjusted mix design used to place the acceptable control strip. Upon acceptance of the control strip by the RPR, the Contractor must use the same equipment, materials, and construction methods for the remainder of concrete paving. Any adjustments to processes or materials must be approved in advance by the RPR. Acceptable control strips will meet edge slump tolerance and surface acceptable with little or no finishing, air content within action limits, strength equal or greater than requirements of P501-3.3. The control strip will be considered one lot for payment (no sublots required for control strip). Payment will only be made for an acceptable control strip in accordance with paragraph 501-8.1 using a lot pay factor equal to 100.

**501-4.2 Equipment.** The Contractor is responsible for the proper operation and maintenance of all equipment necessary for handling materials and performing all parts of the work to meet this specification.

**a. Plant and equipment.** The plant and mixing equipment shall conform to the requirements of ASTM C94 and/or ASTM C685. Each truck mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades. The truck mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch (19 mm) or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

Equipment for transferring and spreading concrete from the transporting equipment to the paving lane in front of the finishing equipment shall be provided. The equipment shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently.

**b. Finishing equipment.**

**(1) Slip-form.** The standard method of constructing concrete pavements shall be with an approved slip-form paving equipment designed and operated to spread, consolidate, screed, and finish the freshly placed concrete in one complete pass of the machine so that the end result is a dense and homogeneous pavement which is achieved with a minimum of hand finishing. The paver-finisher shall be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements.

**(2) Fixed-form.** On projects requiring less than 10,000 cubic yards (7650 cubic meters) of concrete pavement or irregular areas at locations inaccessible to slip-form paving equipment, concrete pavement may be placed with equipment specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR. Hand screeding and float finishing may only be used on small irregular areas as allowed by the RPR.

**c. Vibrators.** Vibrator shall be the internal type. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation or voids. The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of American Concrete Institute (ACI) 309R, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The Contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the RPR.

Hand held vibrators may only be used in irregular areas and shall meet the recommendations of ACI 309R, Guide for Consolidation of Concrete.

**d. Concrete saws.** The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations.

**e. Fixed forms.** Straight side fixed forms shall be made of steel and shall be furnished in sections not less than 10 feet (3 m) in length. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the RPR. The top face of the form shall not vary from a true plane more than 1/8 inch (3 mm) in 10 feet (3 m), and the upstanding leg shall not vary more than 1/4 inch (6 mm). The forms shall contain provisions for locking the ends of

abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when approved by the RPR. The forms shall extend the full depth of the pavement section.

**501-4.3 Form setting.** Forms shall be set to line and grade as shown on the plans, sufficiently in advance of the concrete placement, to ensure continuous paving operation. Forms shall be set to withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the concrete placement.

**501-4.4 Base surface preparation prior to placement.** Any damage to the prepared base, subbase, and subgrade shall be corrected full depth by the Contractor prior to concrete placement. The underlying surface shall be entirely free of frost when concrete is placed. The prepared grade shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete.

**501-4.5 Handling, measuring, and batching material.** Aggregate stockpiles shall be constructed and managed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Store and maintain all aggregates at a uniform moisture content prior to use. A continuous supply of materials shall be provided to the work to ensure continuous placement.

**501-4.6 Mixing concrete.** The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials are placed into the drum until the drum is emptied into the truck. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C94 or ASTM C685.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is discharged from the truck should not exceed 30 minutes when the concrete is hauled in non-agitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. In no case shall the temperature of the concrete when placed exceed 90°F (32°C). Retempering concrete by adding water or by other means will not be permitted. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified is not exceeded.

**501-4.7 Weather Limitations on mixing and placing.** No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

**a. Cold weather.** Unless authorized in writing by the RPR, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40°F (4°C) and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F (2°C).

The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50°F (10°C) at the time of placement. Concrete shall not be placed on frozen material nor shall frozen aggregates be used in the concrete.

When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150°F (66°C). The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

Curing during cold weather shall be in accordance with paragraph 501-4.13d.

**b. Hot weather.** During periods of hot weather when the maximum daily air temperature exceeds 85°F (30°C), the following precautions shall be taken.

The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90°F (32°C). The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

The concrete placement shall be protected from exceeding an evaporation rate of 0.2 psf (0.98 kg/m<sup>2</sup> per hour) per hour. When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor shall immediately take such additional measures as necessary to protect the concrete surface. If the Contractor's measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

Curing during hot weather shall be in accordance with paragraph 501-4.13e.

**c. Temperature management program.** Prior to the start of paving operation for each day of paving, the Contractor shall provide the RPR with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. (Federal Highway Administration HIPERPAV 3 is one example of a temperature management program.) As a minimum, the program shall address the following items:

(1) Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.

(2) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity; and anticipated evaporation rate using Figure 19-9, PCA, Design and Control of Concrete Mixtures.

(3) Anticipated timing of initial sawing of joint.

(4) Anticipated number and type of saws to be used.

**d. Rain.** The Contractor shall have available materials for the protection of the concrete during inclement weather. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils (0.1 mm) thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

**501-4.8 Concrete Placement.** At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet (1 m). The finished concrete product must be dense and homogeneous, without segregation and conforming to the standards in this specification. Backhoes and grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders will not be used. All concrete shall be consolidated without voids or segregation, including under and around all load-transfer devices, joint assembly units, and other features embedded in the pavement. Hauling equipment or other mechanical equipment can be permitted on adjoining previously constructed pavement when the concrete strength reaches a flexural strength of 550 psi, based on the average of four field cured specimens per 2,000 cubic yards (1,530 cubic meters) of concrete placed. The Contractor must determine that the above minimum strengths are adequate to protection the pavement from overloads due to the construction equipment proposed for the project.

**The Contractor shall have available materials for the protection of the concrete during cold, hot and/or inclement weather in accordance with paragraph 501-4.7.**

**a. Slip-form construction.** The concrete shall be distributed uniformly into final position by a self-propelled slip-form paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well-defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit shall not exceed 9 inches (23 cm) for slipform and at the end of the dowels for the fill-in lanes. The spacing of internal units shall be uniform and shall not exceed 18 inches (0.5 m).

The term internal vibration means vibrating units located within the specified thickness of pavement section.

The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation, voids, or vibrator trails and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at least one foot (30 cm). The frequency of vibration or amplitude should be adjusted proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

Not more than 15% of the total free edge of each 500-foot (150 m) segment of pavement, or fraction thereof, shall have an edge slump exceeding 1/4 inch (6 mm), and none of the free edge of the pavement shall have an edge slump exceeding 3/8 inch (9 mm). (The total free edge of 500 feet (150 m) of pavement will be considered the cumulative total linear measurement of pavement edge originally constructed as nonadjacent to any existing pavement; that is, 500 feet (150 m) of paving lane originally constructed as a separate lane will have 1,000 feet (300 m) of free edge, 500 feet (150 m) of fill-in lane will have no free edge, etc.). The area affected by the downward movement of the concrete along the pavement edge shall be limited to not more than 18 inches (0.5 m) from the edge.

When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive edge slump will be removed the full width of the slip form lane and replaced at the expense of the Contractor as directed by the RPR.

**b. Fixed-form construction.** Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars / dowel bars where these are specified.

Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms. Curing compound shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and coated with a release agent each time they are used and before concrete is placed against them.

Concrete shall be spread, screed, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross-section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery. The equipment must be specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR.

Concrete for the full paving width shall be effectively consolidated by internal vibrators. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation, voids, or leaving vibrator trails.

Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped.

**c. Consolidation.** Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches (50 mm). Vibrators shall not be used to transport or spread the concrete. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) or over-consolidation (vibrator trails, segregation, or any other evidence) shall require the immediate stopping of the paving operation and adjustment of the equipment or procedures as approved by the RPR.

If a lack of consolidation of the hardened concrete is suspected by the RPR, referee testing may be required. Referee testing of hardened concrete will be performed by the RPR by cutting cores from the finished pavement after a minimum of 24 hours curing. The RPR shall visually examine the cores for evidence of lack of consolidation. Density determinations will be made by the RPR based on the water content of the core as taken. ASTM C642 shall be used for the determination of core density in the saturated-surface dry condition. When required, referee cores will be taken at the minimum rate of one for each 500 cubic yards (382 m<sup>2</sup>) of pavement, or fraction. The Contractor shall be responsible for all referee testing cost if they fail to meet the required density.

The average density of the cores shall be at least 97% of the original concrete mix density, with no cores having a density of less than 96% of the original concrete mix density. Failure to meet the referee tests will be considered evidence that the minimum requirements for vibration are inadequate for the job conditions. Additional vibrating units or other means of increasing the effect of vibration shall be employed so that the density of the hardened concrete conforms to the above requirements.

**501-4.9 Strike-off of concrete and placement of reinforcement.** Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the plans and to an elevation that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screed. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement

may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

**501-4.10 Joints.** Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2-inch (12 mm) from their designated position and shall be true to line with not more than 1/4-inch (6 mm) variation in 10 feet (3 m). The surface across the joints shall be tested with a 12-foot (3 m) straightedge as the joints are finished and any irregularities in excess of 1/4 inch (6 mm) shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

**a. Construction.** Longitudinal construction joints shall be slip-formed or formed against side forms as shown in the plans.

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

**b. Contraction.** Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall be installed to the dimensions required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch (3 mm) wide and to the depth shown on the plans.

**c. Isolation (expansion).** Isolation joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint. The filler shall be fastened uniformly along the hardened joint face with no buckling or debris between the filler and the concrete interface, including a temporary filler for the sealant reservoir at the top of the slab. The edges of the joint shall be finished and tooled while the concrete is still plastic.

**d. Dowels and Tie Bars for Joints**

**(1) Tie bars.** Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth and within the tolerances in paragraph 501-4.10(f.). When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. Tie bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed.

**(2) Dowel bars.** Dowel bars shall be placed across joints in the proper horizontal and vertical alignment as shown on the plans. The dowels shall be coated with a bond-breaker or other lubricant recommended by the manufacturer and approved by the RPR. Dowel bars at longitudinal construction joints shall be bonded in drilled holes.

**(3) Placing dowels and tie bars.** Horizontal spacing of dowels shall be within a tolerance of  $\pm 3/4$  inch (19 mm). The vertical location on the face of the slab shall be within a tolerance of  $\pm 1/2$  inch (12 mm). The method used to install dowels shall ensure that the horizontal and vertical alignment will not be greater than  $1/4$  inch per foot (6 mm per 0.3 m), except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge. The portion of each dowel intended to move within the concrete or expansion cap shall be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels shall be installed as specified in the following subparagraphs.

Dowels and tie bars shall not be placed closer than 0.6 times the dowel bar or tie bar length to the planned joint line. If the last regularly spaced longitudinal dowel and/or tie bar is closer than that dimension, it shall be moved away from the joint to a location 0.6 times the dowel bar and/or tie bar length, but not closer than 6 inches (150 mm) to its nearest neighbor.

**a. Contraction joints.** Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. Do not cut or crimp the dowel basket tie wires.

At the Contractor's option, dowels and tie bars in contraction joints may be installed by insertion into the plastic concrete using approved equipment and procedures per the paver manufacturer's design. Approval of installation methods will be based on the results of the control strip showing that the dowels and tie bars are installed within specified tolerances as verified by cores or non-destructive rebar location devices approved by the RPR.

**b. Construction joints.** Install dowels and tie bars by the cast-in-place or the drill-and-dowel method. Installation by removing and replacing in preformed holes will not be permitted. Dowels and tie bars shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms.

**c. Joints in hardened concrete.** Install dowels in hardened concrete by bonding the dowels into holes drilled into the concrete. The concrete shall have cured for seven (7) days or reached a minimum flexural strength of 450 psi (3.1 MPa) before drilling begins. Holes  $1/8$  inch (3 mm) greater in diameter than the dowels shall be drilled into the hardened concrete using rotary-core drills. Rotary-percussion drills may be used, provided that excessive spalling does not occur. Spalling beyond the limits of the grout retention ring will require modification of the equipment and operation. Depth of dowel hole shall be within a tolerance of  $\pm 1/2$  inch (12 mm) of the dimension shown on the drawings. On completion of the drilling operation, the dowel hole shall be blown out with oil-free, compressed air. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel will not be permitted. The dowels shall be held in alignment at the collar of the hole by means of a suitable metal or plastic grout retention ring fitted around the dowel.

**d. Sawing of joints.** Sawing shall commence, without regard to day or night, as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs and shall continue without interruption until all joints have been sawn. All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing. Curing compound or system shall be reapplied in the initial saw-cut and maintained for the remaining cure period.

Joints shall be cut in locations as shown on the plans. The initial joint cut shall be a minimum 1/8 inch (3 mm) wide and to the depth shown on the plans. Prior to placement of joint sealant or seals, the top of the joint shall be widened by sawing as shown on the plans.

**501-4.11 Finishing.** Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, edging of joints, and then texturing. Finishing shall be by the machine method. The hand method shall be used only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way. Fog (mist) sprays or other surface applied finishing aids specified to prevent plastic shrinkage cracking, approved by the RPR, may be used in accordance with the manufacturers requirements.

**a. Machine finishing with slipform pavers.** The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled non-rotating pipe float may be used while the concrete is still plastic, to remove minor irregularities and score marks. Only one pass of the pipe float shall be allowed. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Remove excessive slurry from the surface with a cutting straightedge and wipe off the edge. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

**b. Machine finishing with fixed forms.** The machine shall be designed to straddle the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

**c. Other types of finishing equipment.** Clary screeds, other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to the RPR's approval.

Bridge deck finishers shall have a minimum operating weight of 7500 pounds (3400 kg) and shall have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

**d. Hand finishing.** Hand finishing methods will not be permitted, except under the following conditions: (1) in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade and (2) in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical.

**e. Straightedge testing and surface correction.** After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a 12-foot (3.7-m) finishing straightedge swung from handles capable of spanning at least one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8 inch (3 mm) thick shall be removed from the surface of the pavement and wasted. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the smoothness requirements. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross-section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

**501-4.12 Surface texture.** The surface of the pavement shall be finished as designated below for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. The texture shall be uniform in appearance and approximately 1/16 inch (2 mm) in depth. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the RPR.

**a. Brush or broom finish.** Shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface.

~~**b. Burlap drag finish.** Burlap, at least 15 ounces per square yard (555 grams per square meter), will typically produce acceptable texture. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately one foot (30 cm) from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface.~~

~~**e. Artificial turf finish.** Shall be applied by dragging the surface of the pavement in the direction of concrete placement with an approved full-width drag made with artificial turf. The leading transverse edge of the artificial turf drag will be securely fastened to a lightweight pole on a traveling bridge. At least 2 feet (60 cm) of the artificial turf shall be in contact with the concrete surface during dragging operations. Approval of the artificial turf will be done only after it has been demonstrated by the Contractor to provide a satisfactory texture. One type that has provided satisfactory texture consists of 7,200 approximately 0.85-inch long polyethylene turf blades per square foot.~~

**501-4.13 Curing.** Immediately after finishing operations are completed and bleed water is gone from the surface, all exposed surfaces of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-saw-cut method is used to construct the contraction joint, the curing compound shall be applied to the saw-cut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

**a. Impervious membrane method.** Curing with liquid membrane compounds should not occur until bleed and surface moisture has evaporated. All exposed surfaces of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of one gallon (4 liters) to not

more than 150 square feet (14 sq m). The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the RPR, a double application rate shall be used to ensure coverage. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

~~**b. White burlap polyethylene sheets.** The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for seven (7) days after the concrete has been placed.~~

~~**e. Water method.** The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.~~

**d. Concrete protection for cold weather.** Maintain the concrete at a temperature of at least 50°F (10°C) for a period of 72 hours after placing and at a temperature above freezing for the remainder of the 7-day curing period. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged shall be removed and replaced at the Contractor's expense.

**e. Concrete protection for hot weather.** Concrete should be continuous moisture cured for the entire curing period and shall commence as soon as the surfaces are finished and continue for at least 24 hours. However, if moisture curing is not practical beyond 24 hours, the concrete surface shall be protected from drying with application of a liquid membrane-forming curing compound while the surfaces are still damp. Other curing methods may be approved by the RPR.

**501-4.14 Removing forms.** Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab shall be cured in accordance with paragraph 501-4.13.

If honeycombed areas are evident when the forms are removed, materials, placement, and consolidation methods must be reviewed and appropriate adjustments made to assure adequate consolidation at the edges of future concrete placements. Honeycombed areas that extend into the slab less than approximately 1 inch (25 mm), shall be repaired with an approved grout, as directed by the RPR. Honeycombed areas that extend into the slab greater than a depth of 1 inch (25 mm) shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-4.19.

**501-4.15 Saw-cut grooving.** If shown on the plans, grooved surfaces shall be provided in accordance with the requirements of Item P-621.

**501-4.16 Sealing joints.** The joints in the pavement shall be sealed in accordance with Item P-605.

**501-4.17 Protection of pavement. Protection of pavement.** The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents until accepted by the RPR. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from

intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense.

Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least seven (7) days old, or for a longer period if directed by the RPR.

In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days, the joints are protected, the concrete has attained a minimum field cured flexural strength of [ 450 psi (3100 kPa) ], and the slab edge is protected.

All new and existing pavement carrying construction traffic or equipment shall be kept clean and spillage of concrete and other materials shall be cleaned up immediately.

Damaged pavements shall be removed and replaced at the Contractor's expense. Slabs shall be removed to the full depth, width, and length of the slab.

**501-4.18 Opening to construction traffic.** The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of 550 pounds per square inch (3100 kPa) when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion.

**501-4.19 Repair, removal, or replacement of slabs.** New pavement slabs that are broken or contain cracks or are otherwise defective or unacceptable as defined by acceptance criteria in paragraph 501-6.6 shall be removed and replaced or repaired, as directed by the RPR, at the Contractor's expense. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. Removal and replacement shall be full depth, shall be full width of the slab, and the limit of removal shall be normal to the paving lane and to each original transverse joint. The RPR will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be have a diameter of 2 inches (50 mm) to 4 inches (100 mm), shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with a bonding agent, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Owner. Repair of cracks as described in this section shall not be allowed if in the opinion of the RPR the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of cracks shall be allowed in any panel that demonstrates segregated aggregate with an absence of coarse aggregate in the upper 1/8 inch (3 mm) of the pavement surface.

**a. Shrinkage cracks.** Shrinkage cracks which do not exceed one-third of the pavement depth shall be cleaned and either high molecular weight methacrylate (HMWM) applied; or epoxy resin (Type IV, Grade 1) pressure injected using procedures recommended by the manufacturer and approved by the RPR. Sandblasting of the surface may be required following the application of HMWM to restore skid resistance. Care shall be taken to ensure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the RPR. Shrinkage cracks which exceed one-third the pavement depth shall be treated as full depth cracks in accordance with paragraphs 501-4.19b and 501-19c.

**b. Slabs with cracks through interior areas.** Interior area is defined as that area more than 6 inches (150 mm) from either adjacent original transverse joint. The full slab shall be removed and replaced at no cost to the Owner, when there are any full depth cracks, or cracks greater than one-third the pavement depth, that extend into the interior area.

**c. Cracks close to and parallel to joints.** All full-depth cracks within 6 inches (150 mm) either side of the joint and essentially parallel to the original joints, shall be treated as follows.

**(1) Full depth cracks and original joint not cracked.** The full-depth crack shall be treated as the new joint and the original joint filled with an epoxy resin.

**i. Full-depth crack.** The joint sealant reservoir for the crack shall be formed by sawing to a depth of 3/4 inches (19 mm),  $\pm 1/16$  inch (2 mm), and to a width of 5/8 inch (16 mm),  $\pm 1/8$  inch (3 mm). The crack shall be sawed with equipment specially designed to follow random cracks. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent raveling or spalling. The joint shall be sealed with sealant in accordance with P-605 or as directed by the RPR.

**ii. Original joint.** If the original joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures.

If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures.

Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remainder of the width, it shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

**(2) Full depth cracks and original joint cracked.** If there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab containing the crack shall be removed and replaced.

**d. Removal and replacement of full slabs.** Make a full depth cut perpendicular to the slab surface along all edges of the slab with a concrete saw cutting any dowels or tie-bars. Remove damaged slab protecting adjacent pavement from damage. Damage to adjacent slabs may result in removal of additional slabs as directed by the RPR at the Contractor's expense.

The underlying material shall be repaired, re-compacted and shaped to grade.

Dowels of the size and spacing specified for other joints in similar pavement on the project shall be installed along all four (4) edges of the new slab in accordance with paragraph 501-4.10d.

Placement of concrete shall be as specified for original construction. The joints around the new slab shall be prepared and sealed as specified for original construction.

**e. Spalls along joints.**

**(1)** Spalls less than one inch wide and less than the depth of the joint sealant reservoir, shall be filled with joint sealant material.

**(2)** Spalls larger than one inch and/or deeper than the joint reservoir, but less than 1/2 the slab depth, and less than 25% of the length of the adjacent joint shall be repaired as follows:

**i.** Make a vertical saw cut at least one inch (25 mm) outside the spalled area and to a depth of at least 2 inches (50 mm). Saw cuts shall be straight lines forming rectangular areas surrounding the spalled area.

**ii.** Remove unsound concrete and at least 1/2 inch (12 mm) of visually sound concrete between the saw cut and the joint or crack with a light chipping hammer.

**iii.** Clean cavity with high-pressure water jets supplemented with compressed air as needed to remove all loose material.

**iv.** Apply a prime coat of epoxy resin, Type III, Grade I, to the dry, cleaned surface of all sides and bottom of the cavity, except any joint face.

**v.** Fill the cavity with low slump concrete or mortar or with epoxy resin concrete or mortar.

vi. An insert or other bond-breaking medium shall be used to prevent bond at all joint faces.

vii. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and sealed with the sealer specified for the joints.

(3) Spalls deeper than 1/2 of the slab depth or spalls longer than 25% of the adjacent joint require replacement of the entire slab.

**f. Diamond grinding of Concrete surfaces.** Diamond grinding shall be completed prior to pavement grooving. Diamond grinding of the hardened concrete should not be performed until the concrete is at least 14 days old and has achieved full minimum strength. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The depth of diamond grinding shall not exceed 1/2 inch (13 mm) and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified.

Diamond grinding shall be performed with a machine specifically designed 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 sufficient number of flush cut blades that 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 Contractor shall determine the number and type of blades based on the hardness of the aggregate. 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. All grinding shall be at the expense of the Contractor.

### CONTRACTOR QUALITY CONTROL (CQC)

**501-5.1 Quality control program.** The Contractor shall develop a Quality Control Program in accordance with Item C-100. No partial payment will be made for materials that are subject to specific quality control requirements without an approved quality control program.

**501-5.2 Contractor Quality Control (CQC).** 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.

**501-5.3 Contractor QC testing.** The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to this specification and as set forth in the CQCP. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content. A QC Testing Plan shall be developed and approved by the RPR as part of the CQCP.

The RPR may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, or improper slump. Such rejection may be based on only visual inspection. 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.

**a. Fine aggregate.**

**(1) Gradation.** A sieve analysis shall be made at least twice daily in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

**(2) Moisture content.** If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C70 or ASTM C566.

**(3) Deleterious substances.** Fine aggregate as delivered to the mixer shall be tested for deleterious substances in fine aggregate for concrete as specified in paragraph 501-2.1b, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

**b. Coarse Aggregate.**

**(1) Gradation.** A sieve analysis shall be made at least twice daily for each size of aggregate. Tests shall be made in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

**(2) Moisture content.** If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C566.

**(3) Deleterious substances.** Coarse aggregate as delivered to the mixer shall be tested for deleterious substances in coarse aggregate for concrete as specified in paragraph 501-2.1c, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

**c. Slump.** One test shall be made for each subplot. Slump tests shall be performed in accordance with ASTM C143 from material randomly sampled from material discharged from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

**d. Air content.** One test shall be made for each subplot. Air content tests shall be performed in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag or other porous coarse aggregate, from material randomly sampled from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

**e. Unit weight and Yield.** One test shall be made for each subplot. Unit weight and yield tests shall be in accordance with ASTM C138. The samples shall be taken in accordance with ASTM C172 and at the same time as the air content tests.

**f. Temperatures.** Temperatures shall be checked at least four times per lot at the job site in accordance with ASTM C1064.

**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 (3.7m) straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each

successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using the FAA profile program, ProFAA, or FHWA ProVal, using the 12-foot straightedge simulation function.

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

**(1) Transverse measurements.** Transverse measurements shall be taken for each day's production placed. Transverse measurements shall be taken perpendicular to the pavement centerline each 50 feet (15 m) or more often as determined by the 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.

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 501-4.19f 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 501-6.6.

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 will be evaluated prior to and after placement of the concrete surface.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically and 0.1 feet (30 mm) laterally. The documentation will be provided by the Contractor to the RPR within 48 hours.

Areas with humps or depression that exceed grade or smoothness 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. If these areas cannot be corrected with grinding then the slabs that are retaining water must be removed and replaced in accordance with paragraph 501-4.19d. Grinding shall be in accordance with paragraph 501-4.19f. All corrections will be at the Contractors expense.

**501-5.4 Control charts.** The Contractor shall maintain linear control charts for fine and coarse aggregate gradation, slump, and air content. The Contractor shall also maintain a control chart plotting the coarseness factor/workability factor from the combined gradations in accordance with paragraph 501-2.1d.

Control charts shall be posted in a location satisfactory to the RPR and shall be kept up to date at all times. 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, or Specification 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 potential problem and the Contractor is not taking satisfactory corrective action, the RPR may halt production or acceptance of the material.

**a. Fine and coarse aggregate gradation.** The Contractor shall record the running average of the last five gradation tests for each control sieve on linear control charts. Superimposed on the control charts shall be the action and suspension limits. Gradation tests shall be performed by the Contractor per ASTM C136. The Contractor shall take at least two samples per lot to check the final gradation. Sampling shall be per ASTM D75 from the flowing aggregate stream or conveyor belt.

**b. Slump and air content.** The Contractor shall maintain linear control charts both for individual measurements and range (that is, difference between highest and lowest measurements) for slump and air content in accordance with the following Action and Suspension Limits.

**c. Combined gradation.** The Contractor shall maintain a control chart plotting the coarseness factor and workability factor on a chart in accordance with paragraph 501-2.1d.

#### Control Chart Limits<sup>1</sup>

Control Parameter	Individual Measurements	
	Action Limit	Suspension Limit
Gradation <sup>2</sup>	*3	*3
Coarseness Factor (CF)	±3.5	±5
Workability Factor (WF)	±2	±3
Slump	+0.5 to -1 inch (+13 to -25 mm)	+1 to -1.5 inch (+25 to -38 mm)
Air Content	±1.5%	±2.0%

<sup>1</sup> Control charts shall developed and maintained for each control parameter indicated.

<sup>2</sup> Control charts shall be developed and maintained for each sieve size.

<sup>3</sup> Action and suspension limits shall be determined by the Contractor.

**501-5.5 Corrective action at Suspension Limit.** The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of control. The CQCP shall detail what action will be taken to bring the process into control and shall contain sets of rules to gauge when a process is out of control. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the following conditions exists.

**a. Fine and coarse aggregate gradation.** When two consecutive averages of five tests are outside of the suspension limits, immediate steps, including a halt to production, shall be taken to correct the grading.

**b. Coarseness and Workability factor.** When the CF or WF reaches the applicable suspension limits, the Contractor, immediate steps, including a halt to production, shall be taken to correct the CF and WF.

**c. Fine and coarse aggregate moisture content.** Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5%, the scale settings for the aggregate batcher and water batcher shall be adjusted.

**d. Slump.** The Contractor shall halt production and make appropriate adjustments whenever:

(1) one point falls outside the Suspension Limit line for individual measurements

OR

(2) two points in a row fall outside the Action Limit line for individual measurements.

e. Air content. The Contractor shall halt production and adjust the amount of air-entraining admixture whenever:

- (1) one point falls outside the Suspension Limit line for individual measurements
- OR
- (2) two points in a row fall outside the Action Limit line for individual measurements.

## **MATERIAL ACCEPTANCE**

**501-6.1 Quality Assurance (QA) Acceptance sampling and testing.** All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section, with the exception of coring for thickness determination, will be performed by the RPR. The Contractor shall provide adequate facilities for the initial curing of beams. The Contractor shall bear the cost of providing initial curing facilities and coring and filling operations, per paragraph 501-6.5b(1).

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60° to 80°F (16° to 27°C), and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.

**501-6.2 Quality Assurance (QA) testing laboratory.** Quality assurance testing organizations performing these acceptance tests will be accredited in accordance with ASTM C1077. The quality assurance laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods will be submitted to the RPR prior to start of construction.

**501-6.3 Lot size.** Concrete will be accepted for strength and thickness on a lot basis. A lot will consist of a day's production not to exceed 6,000 square yards. Each lot will be divided into approximately equal sublots with individual sublots between 1200 to 1800 square yards. Where three sublots are produced, they will constitute a lot. Where one or two sublots are produced, they will be incorporated into the previous or next lot. Where more than one plant is simultaneously producing concrete for the job, the lot sizes will apply separately for each plant.

**501-6.4 Partial lots.** When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot or for overages or minor placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

Where three sublots have been produced, they will constitute a lot. Where one or two sublots have been produced, they will be incorporated into the next lot or the previous lot and the total number of sublots will be used in the acceptance criteria calculation, that is,  $n=5$  or  $n=6$ .

### **501-6.5 Acceptance Sampling and Testing.**

#### **a. Strength.**

(1) **Sampling.** One sample will be taken for each sublot from the concrete delivered to the job site. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. The concrete will be sampled in accordance with ASTM C172.

(2) **Test Specimens.** The RPR will be responsible for the casting, initial curing, transportation, and curing of specimens in accordance with ASTM C31. Two (2) specimens will be made from each sample and slump, air content, unit weight, and temperature tests will be conducted for each set of strength

specimens. Within 24 to 48 hours, the samples will be transported from the field to the laboratory while in the molds. Samples will be cured in saturated lime water.

The strength of each specimen will be determined in accordance with ASTM C78. The strength for each subplot will be computed by averaging the results of the two test specimens representing that subplot.

**(3) Acceptance.** Acceptance of pavement for strength will be determined by the RPR in accordance with paragraph 501-6.6b(1). All individual strength tests within a lot will be checked for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and the remaining test values will be used to determine acceptance in accordance with paragraph 501-6.5b.

**b. Pavement thickness.**

**(1) Sampling.** One core will be taken by the Contractor for each subplot in the presence of the RPR. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. Areas, such as thickened edges, with planned variable thickness, will be excluded from sample locations.

Cores shall be a minimum 4 inch (100 mm) in diameter neatly cut with a core drill. The Contractor will furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes will be filled by the Contractor with a non-shrink grout approved by the RPR within one day after sampling.

**(2) Testing.** The thickness of the cores will be determined by the RPR by the average caliper measurement in accordance with ASTM C174. Each core shall be photographed and the photograph included with the test report.

**(3) Acceptance.** Acceptance of pavement for thickness will be determined by the RPR in accordance with paragraph 501-6.6.

**501-6.6 Acceptance criteria.**

**a. General.** Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-6.5b:

- (1) Strength
- (2) Thickness
- (3) Grade
- (4) Profilograph smoothness - Not used
- (5) Adjustments for repairs

Acceptance for strength, thickness, and grade, will be based on the criteria contained in accordance with paragraph 501-6.6b(1), 501-6.6b(2), and 501-6.6b(3), respectively.

Strength and thickness will be evaluated for acceptance on a lot basis using the method of estimating PWL. Production quality must achieve 90 PWL or higher to receive full pavement. The PWL will be determined in accordance with procedures specified in Item C-110.

The lower specification tolerance limit (L) for strength and thickness will be:

Lower Specification Tolerance Limit (L)

Strength	$0.93 \times$ strength specified in paragraph 501-3.3
Thickness	Lot Plan Thickness in inches, - 0.50 in

**b. Acceptance criteria.**

**(1) Strength.** If the PWL of the lot equals or exceeds 90%, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

**(2) Thickness.** If the PWL of the lot equals or exceeds 90%, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

**(3) Grade.** The final finished surface of the pavement of the completed project will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically or 0.1 feet (30 mm) laterally. The documentation, stamped and signed by a licensed surveyor shall be in accordance with paragraph 501-5.3h. Payment for sublots that do not meet grade for over 25% of the subplot shall reduced by 5% and not be more than 95%.

**(4) Profilograph roughness for QA Acceptance.** Not used.

**(5) Adjustments for repair.** Sublots with spall repairs, crack repairs, or partial panel replacement, will be limited to no more than 95% payment.

**(6) Adjustment for grinding.** For sublots with grinding over 25% of a subplot, payment will be reduced 5%.

### METHOD OF MEASUREMENT

**501-7.1** Concrete pavement shall be measured by the number of square yards of reinforced pavement as specified in-place, completed and accepted.

### BASIS OF PAYMENT

**501-8.1 Payment.** Payment for concrete pavement meeting all acceptance criteria as specified in paragraph 501-6.6. Acceptance Criteria shall be based on results of strength and thickness tests. Payment for acceptable lots of concrete pavement shall be adjusted in accordance with paragraph 501-8.1a for strength and thickness; 501-8.1b for repairs; 501-8.1c for grinding; and 501-8.1d for smoothness, subject to the limitation that:

The total project payment for concrete pavement shall not exceed 100 percent of the product of the contract unit price and the total number of square yards of concrete pavement used in the accepted work (See Note 1 under the Price Adjustment Schedule table below).

Payment shall be full compensation for all labor, materials, tools, equipment, and incidentals required to complete the work as specified herein and on the drawings.

**a. Basis of adjusted payment.** The pay factor for each individual lot shall be calculated in accordance with the Price Adjustment Schedule table below. A pay factor shall be calculated for both strength and thickness. The lot pay factor shall be the higher of the two values when calculations for both strength and thickness are 100% or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either strength or thickness is 100% or higher. The lot pay factor shall be the lower of the two values when calculations for both strength and thickness are less than 100%.

### Price Adjustment Schedule<sup>1</sup>

Percentage of Materials Within Specification Limits (PWL)	Lot Pay Factor (Percent of Contract Unit Price)
96 – 100	106
90 – 95	PWL + 10
75 – 90	0.5 PWL + 55
55 – 74	1.4 PWL – 12
Below 55	Reject <sup>2</sup>

<sup>1</sup> Although it is theoretically possible to achieve a pay factor of 106% for each lot, actual payment in excess of 100% shall be subject to the total project payment limitation specified in paragraph 501-8.1.

<sup>2</sup> The lot shall be removed and replaced unless, after receipt of FAA concurrence, the Owner and Contractor agree in writing that the lot will remain; the lot paid at 50% of the contract unit price; and the total project payment limitation reduced by the amount withheld for that lot.

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 501-8.1. Payment in excess of 100% for accepted lots of concrete pavement shall be used to offset payment for accepted lots of concrete pavement that achieve a lot pay factor less than 100%; except for rejected lots which remain in place and/or sublots with adjustments for repairs.

**b. Adjusted payment for repairs.** The PWL lot pay factor shall be reduced by 5% and be no higher than 95% for sublots which contain repairs in accordance with paragraph 501-4.19 on more than 20% of the slabs within the subplot. Payment factors greater than 100 percent for the strength and thickness cannot be used to offset adjustments for repairs.

**c. Adjusted payment for grinding.** The PWL lot pay factor shall be reduced by 5% and be no higher than 95% for sublots with grinding over 25% of a subplot.

**d. Profilograph Roughness.** Not used.

**e. Payment.** Payment shall be made under:

<b>Item P-501-8.1</b>	<b>12" PCC Pavement – per square yard</b>
<b>Item P-501-8.2</b>	<b>6" PCC Pavement – per square yard</b>
<b>Item P-501-8.3</b>	<b>6" to 12" PCC Pavement Transition Slab – per square yard</b>

### 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 A996	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1035	Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1078	Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM C29	Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
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 C70	Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C117	Standard Test Method for Materials Finer than 75- $\mu\text{m}$ (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123	Standard Test Method for Lightweight Particles in Aggregate
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
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 C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in 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 C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C174	Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C227	Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
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 C295	Standard Guide for Petrographic Examination of Aggregates 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 C566	Standard Test Method for Total Evaporable Moisture Content of Aggregates by Drying
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C642	Standard Test Method for Density, Absorption, and Voids in Hardened 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 C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
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 C1064	Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM 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 C1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
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 D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph
ASTM E2133	Standard Test Method for Using a Rolling Inclinator to Measure Longitudinal and Transverse Profiles of a Traveled Surface
American Concrete Institute (ACI)	
ACI 305R	Guide to Hot Weather Concreting
ACI 306R	Guide to Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete
Advisory Circulars (AC)	

AC 150/5320-6                      Airport Pavement Design and Evaluation  
Federal Highway Administration (FHWA)  
    HIPERPAV 3, version 3.2  
Portland Concrete Association (PCA)  
    PCA                              Design and Control of Concrete Mixtures, 16<sup>th</sup> Edition  
U.S. Army Corps of Engineers (USACE) Concrete Research Division (CRD)  
    CRD C662                      Determining the Potential Alkali-Silica Reactivity of Combinations  
  of Cementitious Materials, Lithium Nitrate Admixture and  
  Aggregate (Accelerated Mortar-Bar Method)  
United States Air Force Engineering Technical Letter (ETL)  
    ETL 97-5                      Proportioning Concrete Mixtures with Graded Aggregates for Rigid  
  Airfield Pavements

**END ITEM P-501**

## **Summary of Modifications**

### **Item P-605 Joint Sealants for Pavements**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as Engineer RPR.

Revisions to include the use of Engineer or RPR may be shown throughout the document as Engineer and/or RPR.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**605-2.1 Joint sealants.** Joint sealant materials shall meet the requirements of **ASTM D5893**, Standard Specifications for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavement. Joint sealant shall be self-leveling and shall be compatible with use in concrete and concrete/asphalt joints.

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.

**605-3.2 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, 10 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. Waterblasting equipment.** The Contractor must demonstrate waterblasting equipment including the pumps, hose, guide, and nozzle size, under job conditions, before approval in accordance with paragraph 605-3.3. The Contractor shall demonstrate, in the presence of the RPR that the method cleans the joint and does not damage the joint.

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

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

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

## Item P-605 Joint Sealants for Pavements

### DESCRIPTION

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

### MATERIALS

**605-2.1 Joint sealants.** Joint sealant materials shall meet the requirements of **ASTM D5893**, Standard Specifications for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavement. Joint sealant shall be self-leveling and shall be compatible with use in concrete and concrete/asphalt joints.

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

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

**605-2.3 Bond breaking tapes.** Provide a bond breaking tape or separating material that is a flexible, non-shrinkable, non-absorbing, non-staining, and non-reacting adhesive-backed tape. The material shall have a melting point at least  $5^{\circ}\text{F}$  ( $3^{\circ}\text{C}$ ) 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  $50^{\circ}\text{F}$  ( $10^{\circ}\text{C}$ ) 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, 10 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. Waterblasting equipment.** The Contractor must demonstrate waterblasting equipment including the pumps, hose, guide, and nozzle size, under job conditions, before approval in accordance with paragraph 605-3.3. The Contractor shall demonstrate, in the presence of the RPR that the method cleans the joint and does not damage the joint.

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

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

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

**605-3.3 Preparation of joints.** 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 or waterblaster as specified in paragraph 605-3.2. The newly exposed concrete joint faces and the pavement surface extending a minimum of 1/2 inch (12 mm) from the joint edge shall be sandblasted clean. 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 3/8" 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 for joints in new pavement shall not be measured for payment. Joint sealant for joints in existing pavement, defined as joints that are bound by two existing concrete slabs, shall be measured per Item P-101 of these specifications.

Joints between new PCC pavement and existing pavement will be considered joints in new pavement and will not be measured for payment.

### BASIS OF PAYMENT

**605-5.1** Payment for joint sealing in new pavement shall be considered incidental and no payment shall be made. Payment for joint sealing in existing pavement shall be made per Item P-101 of these specifications.

### REFERENCES

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

ASTM International (ASTM)

ASTM D789

Standard Test Method for Determination of Relative Viscosity of Polyamide (PA)

ASTM D5249

Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

ASTM D5893

Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

Advisory Circulars (AC)

AC 150/5340-30

Design and Installation Details for Airport Visual Aids

**END ITEM P-605**

## **Summary of Modifications**

### **Item P-610 Concrete for Miscellaneous Structures**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and ~~Strikethroughs~~ are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as **Engineer RPR**.

Revisions to include the use of Engineer or RPR may be shown throughout the document as **Engineer and/or RPR**.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**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.

In lieu of the above requirements, a TxDOT Class C mix, per TxDOT Item 421 “Hydraulic Cement Concrete” may be utilized for cast in place concrete other than pavement. The mix used shall meet all the requirements of TxDOT Item 421 and shall be air entrained. All other requirements of this specification shall be met. Acceptance testing shall be per this specification.



## 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
3/4 inch (19 mm)	67
1/2 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 I or II.

**610-2.5 Cementitious materials.**

**a Fly ash.** Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total available alkali content less than 3% per ASTM C311. Fly ash produced in furnace operations using liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the 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 D1752.

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

**610-2.10 Steel reinforcement.** Reinforcing shall consist of Reinforcing Steel or Welded Wire Fabric, as called for in the plans, conforming to the requirements of ASTM A615 and ASTM A1064.

**610-2.11 Materials for curing concrete.** Curing materials shall conform to 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.

In lieu of the above requirements, a TxDOT Class C mix, per TxDOT Item 421 "Hydraulic Cement Concrete" may be utilized for cast in place concrete other than pavement. The mix used shall meet all the requirements of TxDOT Item 421 and shall be air entrained. All other requirements of this specification shall be met. Acceptance testing shall be per this specification.

**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 85°F (30 °C), follow the hot weather concreting recommendations found in ACI 305R, Hot Weather Concreting.

## QUALITY ASSURANCE (QA)

**610-4.1 Quality Assurance sampling and testing.** Concrete for each day's placement will be accepted on the basis of the compressive strength specified in paragraph 610-3.2. The 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 shall be considered incidental and no separate measurement shall be made.

### BASIS OF PAYMENT

**610-6.1** Concrete shall be considered incidental and no separate payment shall be made.

### REFERENCES

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

ASTM International (ASTM)

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704	Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM 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)
<u>ASTM C1365</u>	<u>Standard Test Method for Determination of the Proportion of Phases in Portland Cement and Portland-Cement Clinker Using X-Ray Powder Diffraction Analysis</u>
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**

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## **Summary of Modifications**

### **Item P-620 Runway and Taxiway Marking**

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This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and ~~Strikethroughs~~ are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

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Revisions to include the use of Engineer or RPR may be shown throughout the document as ~~Engineer and/or RPR~~.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**620-3.3 Preparation of surfaces.** Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other contaminants that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the ~~Engineer RPR~~. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

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

**b. Preparation of pavement to remove existing markings.** Existing pavement markings shall be removed by rotary grinding, water blasting, or by other methods approved by the ~~Engineer 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. Fog seal utilizing an asphalt emulsion recommended for this intended purpose by TxDOT, in the publication "Asphalt Materials and Uses" shall be utilized.

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

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



## Item P-620 Runway and Taxiway Marking

### DESCRIPTION

**620-1.1** This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer 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 Engineer Resident Project Representative (RPR) prior to the initial application of markings. The reports can be used for material acceptance or the Engineer RPR may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the Engineer and 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 Engineer and RPR.

#### 620-2.2 Marking materials.

**Table 1. Marking Materials**

Paint <sup>1</sup>				Glass Beads <sup>2</sup>	
Type	Color	Fed Std. 595 Number	Application Rate Maximum	Type	Application Rate Minimum
Waterborne Type I or II	Yellow	33538 or 33655	115 ft <sup>2</sup> /gal	I, Gradation A	7 lb./gal
Waterborne Type I or II	Black	37038	115 ft <sup>2</sup> /gal	N/A	N/A

<sup>1</sup> See paragraph 620-2.2a

<sup>2</sup> See paragraph 620-2.2b

**a Paint.** Paint shall be waterborne in accordance with the requirements of this paragraph. Paint colors shall comply with Federal Standard No. 595.

**Waterborne.** Paint shall meet the requirements of Federal Specification TT-P-1952F, Type I or 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.

**f. Reflective media.** Glass beads for white and yellow paint shall meet the requirements for Federal Specification TT-B-1325D Type I, Gradation A .

Glass beads for red and pink paint shall meet the requirements for Type I, Gradation A.

Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

Glass beads shall not be used in black and green paint.

Type III glass beads shall not be used in red and pink paint.

## CONSTRUCTION METHODS

**620-3.1 Weather limitations.** Painting shall only be performed when the surface is dry, and the ambient temperature and the pavement surface temperature meet the manufacturer's recommendations in accordance with paragraph 620-2.1. Painting operations shall be discontinued when the ambient or surface temperatures does not meet the manufacturer's recommendations. Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns. Markings shall not be applied when weather conditions are forecasts to not be within the manufacturers' recommendations for application and dry time.

**620-3.2 Equipment.** Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type or airless type marking machine with automatic glass bead dispensers suitable for application of traffic paint. It shall produce an even and uniform film thickness and appearance of both paint and glass beads at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray. The marking equipment for both paint and beads shall be calibrated daily.

**620-3.3 Preparation of surfaces.** Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other contaminants that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the Engineer RPR. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

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

**b. Preparation of pavement to remove existing markings.** Existing pavement markings shall be removed by rotary grinding, water blasting, or by other methods approved by the Engineer 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. Fog seal utilizing an asphalt emulsion recommended for this intended purpose by TxDOT, in the publication "Asphalt Materials and Uses" shall be utilized.

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

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

**620-3.4 Layout of markings.** The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be shown on the plans.

**620-3.5 Application.** A period of 30 days shall elapse between placement of surface course or seal coat and application of the permanent paint markings. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the Engineer RPR.

The edges of the markings shall not vary from a straight line more than 1/2 inch (12 mm) in 50 feet (15 m), and marking dimensions and spacing shall be within the following tolerances:

#### **Marking Dimensions and Spacing Tolerance**

<b>Dimension and Spacing</b>	<b>Tolerance</b>
36 inch (910 mm) or less	±1/2 inch (12 mm)
greater than 36 inch to 6 feet (910 mm to 1.85 m)	±1 inch (25 mm)
greater than 6 feet to 60 feet (1.85 m to 18.3 m)	±2 inch (50 mm)
greater than 60 feet (18.3 m)	±3 inch (76 mm)

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted.

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

#### **620-3.6 Application--preformed thermoplastic airport pavement markings.**

Preformed thermoplastic pavement markings not used.

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

**620-3.8 Retro-reflectance.** Reflectance shall be measured with a portable retro-reflectometer meeting ASTM E1710 (or equivalent). A total of 6 readings shall be taken over a 6 square foot area with 3 readings taken from each direction. The average shall be equal to or above the minimum levels of all readings which are within 30% of each other.

### Minimum Retro-Reflectance Values

Material	Retro-reflectance mcd/m <sup>2</sup> /lux		
	White	Yellow	Red
Initial Type I	300	175	35
Initial Type III	600	300	35
Initial Thermoplastic	225	100	35
All materials, remark when less than <sup>1</sup>	100	75	10

<sup>1</sup> Prior to remarking determine if removal of contaminants on markings will restore retro-reflectance

**620-3.9 Protection and cleanup.** After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the Engineer 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

**620-4.1a** The quantity of surface preparation, on new pavement shall be measured by the number of square feet for each type of surface preparation specified in paragraph 620-3.3.

**620-4.1b** The quantity of marking removal shall be measured by the number of square feet of markings removed.

**620-4.1c** The quantity of markings shall be paid for shall be measured by the number of square feet of painting.

**620-4.1d** Reflective media shall not be measured for payment.

### BASIS OF PAYMENT

**620-5.1** This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item complete in place and accepted by the Engineer RPR in accordance with these specifications.

**620-5.1a** Payment for surface preparation shall be made at the contract price for the number of square feet for each type of surface preparation specified in paragraph 620-3.3.

**620-5.2b** Payment for marking removal shall be made at the contract price for the number of square feet of markings removed.

**620-5.2c** Payment for markings shall be made at the contract price for the number of square feet of painting.

**620-5.3d** No payment will be made for reflective media. This item is considered subsidiary to other items in the contract.

Payment will be made under:

Item P-620-5.1a	Surface preparation for new markings – per square foot
Item P-620-5.2b	Pavement Marking Removal – per square foot
Item P-620-5.2c	Yellow Markings (Reflective) – per square foot
Item P-620-5.3d	Black Markings (Non-Reflective) – 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

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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 and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

### MATERIALS

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

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

AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO R73	Standard Practice for Evaluation of Precast Concrete Drainage Productions
ASTM C506	Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C1479	Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
ASTM C1840	Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe

**701-2.3 Concrete.** 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. Rubber gaskets for zinc-coated steel pipe and pre-coated galvanized pipe shall conform to the requirements of ASTM D1056, for the "RE" closed cell grades. Rubber gaskets for steel reinforced thermoplastic ribbed pipe shall conform to the requirements of ASTM F477.

**701-2.5 Joint mortar.** Not used.

**701-2.6 Joint fillers.** Not used.

**701-2.7 Plastic gaskets.** Plastic gaskets shall conform to the requirements of ASTM C990.

**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.** Manufactured in accordance with and conforming to ASTM C1433.

**701-2.10 Precast concrete pipe.** Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification program.

## CONSTRUCTION METHODS

**701-3.1 Excavation.** The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 12 inches (300 mm) on each side. The trench walls shall be approximately vertical.

The Contractor shall comply with all current federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactory jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch (200 mm) or 1/2 inch (12 mm) for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The excavation below grade should be filled with granular material to form a uniform foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The RPR shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

**701-3.2 Bedding.** The bedding surface for the pipe shall provide a foundation of uniform density to support the pipe throughout its entire length.

**a. Rigid pipe.** The pipe bedding shall be constructed uniformly for the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 in when the bedding thickness is less than 6 inches, and 1-1/2 in when the bedding thickness is greater than 6 inches. Bedding shall be loosely placed uncompacted material under the middle third of the pipe prior to placement of the pipe.

**b. Flexible pipe.** For flexible pipe, the bed shall be roughly shaped to fit the pipe, and a bedding blanket of sand or fine granular material shall be provided as follows:

**Flexible Pipe Bedding**

Pipe Corrugation Depth		Minimum Bedding Depth	
inch	mm	inch	mm
1/2	12	1	25
1	25	2	50
2	50	3	75
2-1/2	60	3-1/2	90

**c. Other pipe materials.** For PVC, polyethylene, polypropylene, or fiberglass pipe, the bedding material shall consist of coarse sands and gravels with a maximum particle size of 3/4 inches (19 mm). For pipes installed under paved areas, no more than 12% of the material shall pass the No. 200 (0.075 mm)

sieve. For all other areas, no more than 50% of the material shall pass the No. 200 (0.075 mm) sieve. The bedding shall have a thickness of at least 6 inches (150 mm) below the bottom of the pipe and extend up around the pipe for a depth of not less than 50% of the pipe's vertical outside diameter.

**701-3.3 Laying pipe.** The pipe laying shall begin at the lowest point of the trench and proceed up grade. 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 up grade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer's reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

**701-3.4 Joining pipe.** Joints shall be made with (1) cement mortar, (2) cement grout, (3) rubber gaskets, (4) plastic gaskets, (5) coupling bands.

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

**a. Concrete pipe.** Concrete pipe may be either bell and spigot or tongue and groove. Pipe sections at joints shall be fully seated and the inner surfaces flush and even. Concrete pipe joints shall be sealed with rubber gaskets meeting ASTM C443 when leak resistant joints are required. 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, or Polypropylene pipe.** Joints for PVC, Polyethylene, or 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

**701-3.5 Embedment and Overfill.** Pipes shall be inspected before any fill material is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense.

#### **701-3.5-1 Embedment Material Requirements**

**a. Concrete Pipe.** Embedment material and compaction requirements shall be in accordance with the applicable Type of Standard Installation (Types 1, 2, 3, or 4) per ASTM C1479. If a concrete cradle or CLSM embedment material is used, it shall conform to the plan details.

**b. Plastic and fiberglass Pipe.** Embedment material shall meet the requirements of ASTM D3282, A-1, A-2-4, A-2-5, or A-3. Embedment material shall be free of organic material, stones larger than 1.5 inches in the greatest dimension, or frozen lumps. Embedment material shall extend to 12 inches above the top of the pipe.

**c. Metal Pipe.** Embedment material shall be granular as specified in the contract document and specifications, and shall be free of organic material, rock fragments larger than 1.5 inches in the greatest

dimension and frozen lumps. As a minimum, backfill materials shall meet the requirements of ASTM D3282, A-1, A-2, or A-3. Embedment material shall extend to 12 inches above the top of the pipe.

#### **701-3.5-2 Placement of Embedment Material**

The embedment material shall be compacted in layers not exceeding 6 inches (150 mm) on each side of the pipe and shall be brought up one foot (30 cm) above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the embedment material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the embedment material shall be compacted in layers not exceeding 6 inches (150 mm) and shall be brought up evenly on each side of the pipe to one foot (30 cm) above the top of the pipe. All embedment material shall be compacted to a density required under Item P-152.

Concrete cradles and flowable fills, such as controlled low strength material (CLSM) or controlled density fill (CDF), may be used for embedment provided adequate flotation resistance can be achieved by restraints, weighing, or placement technique.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

#### **701-3.6 Overfill**

Pipes shall be inspected before any overfill is in place. Any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense. Evaluation of any damage to RCP shall be evaluated based on AASHTO R73.

Overfill material shall be placed and compacted in layers as required to achieve compaction to at least 95 percent standard proctor per ASTM D698. The soil shall contain no debris, organic matter, frozen material, or stones with a diameter greater than one half the thickness of the compacted layers being placed.

#### **701-3.7 Inspection Requirements**

An initial post installation inspection shall be performed by the RPR no sooner than 30 days after completion of installation and final backfill. Clean or flush all lines prior to inspection.

### **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. Pipe shall be measured separately by size and class. All fittings shall be included in the footage as typical pipe sections in the pipe being measured.

### **BASIS OF PAYMENT**

**701-5.0** These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

**701-5.1** Payment will be made at the contract unit price per linear foot (meter) for each size and class of pipe.

Payment will be made under:

Item 701-5.1	13 ½" x 22" ASTM C506, Class A-IV Arch RCP – per linear foot
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Item 701-5.2                      8" AASHTO M252, Dual Wall Corrugated, Smooth Interior HDPE Pipe – 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 ITEM D-701**

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## **Item D-752 Concrete Culverts, Headwalls, and Miscellaneous Drainage Structures**

### **DESCRIPTION**

**752-1.1** This item shall consist of reinforced concrete culverts, headwalls, and miscellaneous drainage structures constructed 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**

**752-2.1 Concrete.** Reinforced concrete shall meet the requirements of Item P-610.

### **CONSTRUCTION METHODS**

#### **752-3.1 Unclassified excavation.**

**a.** Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades and elevations shown on the plans. 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 approximate only; and the RPR may approve, in writing, changes in dimensions or elevations of footings necessary to secure 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. When 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 steel is placed.

**c.** The Contractor shall do all bracing, sheathing, or shoring necessary to perform 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 excavation.

**d.** All bracing, sheathing, or shoring shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage the finished concrete. The cost of removal shall be included in the unit price bid for excavation.

**e.** After each excavation is completed, 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.

#### **752-3.2 Backfilling.**

**a.** After a structure has been completed, backfilling with approved material shall be accomplished by applying the fill in horizontal layers not to exceed 8 inches (200 mm) in loose depth, and compacted. The field density of the compacted material shall be at least 90% of the maximum density for cohesive soils and 95% of the maximum density for noncohesive soils. The maximum density shall be determined in accordance with ASTM D698. The field density shall be determined in accordance with ASTM D1556.

**b.** No backfilling shall be placed against any structure until approved by the RPR. For concrete, 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 or the placement methods.

**c.** Fill placed around concrete culverts shall be deposited on each side at the same time and to approximately the same elevation. All slopes bounding or within the areas to be backfilled shall be stepped or serrated to prevent wedge action against the structure.

**d.** Backfill will not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for “unclassified excavation for structures.”

**752-3.3 Weep holes.** Weep holes shall be constructed as shown on the plans.

**752-3.4 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 embankment, 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**

**752-4.1** The quantity of each structure shall be measured per each, completed and in place, according to the plans.

### **BASIS OF PAYMENT**

**752-5.1** Payment will be made at the contract unit price per each structure by size.

These prices shall be full compensation for furnishing all materials and for all preparation, excavation, and placing the materials, and for all labor, equipment, tools, and incidentals necessary to complete the structure.

Payment will be made under:

Item D-752-5.1	6:1 SET for 13 ½” x 22” Arch RCP – per each
Item D-752-5.2	6:1 SET for 4-8” HDPE Pipes – 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 D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> ))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

### **END OF ITEM D-752**

## Item D-754 Concrete Gutters, Ditches, and Flumes

### DESCRIPTION

**754-1.1** This item shall consist of Portland cement concrete gutters, ditches, and flumes constructed in accordance with these specifications at the specified locations in accordance with the dimensions, lines, and grades as shown on the plans.

### MATERIALS

**754-2.1 Concrete.** Plain and reinforced concrete shall meet the requirements of Item P-610.

**754-2.2 Joints.** Joint filler materials and premolded joint material shall conform to Item P-605.

### CONSTRUCTION METHODS

**754-3.1 Preparing subgrade.** Excavation shall be made to the required width and depth, and the subgrade upon which the item is to be built shall be compacted to a firm uniform grade. All soft and unsuitable material shall be removed and replaced with suitable approved material. When required, a layer of approved granular material, compacted to the thickness indicated on the plans, shall be placed to form a subbase. The underlying course shall be checked and accepted by the RPR before placing and spreading operations are started.

**754-3.2 Placing.** The forms and the mixing, placing, finishing, and curing of concrete shall conform to the requirements of Item P-610 and the following requirements.

The concrete shall be tamped until it is consolidated and mortar covers the top surface. The surface of the concrete shall be floated smooth and the edges rounded to the radii shown on the plans. Before the concrete is given the final finishing, the surface shall be tested with a 12-foot (3.7-m) straightedge, and any irregularities of more than 1/4 inch (6 mm) in 12-foot (3.7-m) shall be eliminated.

The concrete shall be placed with dummy-grooved joints not to exceed 25 feet (7.5 m) apart and no section shall be less than 4 feet (1.2 m) long.

Expansion joints of the type called for in the plans shall be constructed to replace dummy groove joints at a spacing of approximately 100 feet (30 m). When the gutter is placed next to concrete pavement, expansion joints in the gutter shall be located opposite expansion joints in the pavement. When a gutter abuts a pavement or other structure, an expansion joint shall be placed between the gutter and the other structure.

Forms shall not be removed within 24 hours after the concrete has been placed. Minor defects shall be repaired with mortar containing one (1) part cement and two (2) parts fine aggregate.

Depositing, compacting, and finishing the item shall be conducted to build a satisfactory structure. If any section of concrete is found to be porous, or is otherwise defective, it shall be removed and replaced by the Contractor without additional compensation.

**754-3.3 Backfilling.** After the concrete has set sufficiently, the spaces adjacent to the structure shall be refilled to the required elevation with material specified on the plans and compacted by mechanical equipment to at least 90% of the maximum density as determined by ASTM D698. The in-place density shall be determined in accordance with ASTM D1556.

**754-3.4 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 ordered 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.

Performance of the work described in this section shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for the structure.

#### **METHOD OF MEASUREMENT**

**754-4.1** Concrete flume shall be measured by the square yard of reinforced flume as specified in-place, complete and accepted in accordance with the dimensions shown on the plans or ordered by the Engineer.

#### **BASIS OF PAYMENT**

**754-5.1** Concrete flume will be paid for at the contract unit price per square yard complete in place. Payment shall be full compensation for all labor, materials, tools, equipment, and incidentals required to complete the work as specified herein and on the drawings.

Payment will be made under:

Item D-754-5.1	4" Concrete Flume - per square yard
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#### **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 D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> ))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

**END OF ITEM D-754**

## **Summary of Modifications**

### **Item T-904 Sodding**

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This modification page modifies, amplifies, or amends the technical specifications and plans. **Highlights** and **Strikethroughs** are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as **Engineer** ~~RPR~~.

Revisions to include the use of Engineer or RPR may be shown throughout the document as **Engineer** and/or **RPR**.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**904-2.1 Sod.** Sod furnished by the Contractor shall have a good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. Sod shall be cut or stripped from living, thickly matted turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials that might be detrimental to the development of the sod or to future maintenance. At least 70% of the plants in the cut sod shall be composed of **Bermuda Grass** ~~the species stated in the special provisions~~, and any vegetation more than 6 inches (150 mm) in height shall be mowed to a height of 3 inches (75 mm) or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not less than that stated in the special provisions.

**904-2.3 Fertilizer.** Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified, and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

- a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
- b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
- c. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 10-10-10 commercial fertilizer and shall be spread at the rate of 500 lbs. per acre. **The contractor may make adjustments to the fertilizer used and the rate at which it is applied, with Engineer approval.**

**904-3.6 Watering.** Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner that will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface. **Watering shall be per TxDOT Item 168. The rate of watering shall be as shown in the plans.**

**904-4.1** This item shall be measured on the basis of the area in square yards (square meters) of the surface covered with sod and accepted. **Watering will be measured per TxDOT Item 168.**

**904-5.1** This item will be paid for on the basis of the contract unit price per square yard (square meter) for sodding, which price shall be full compensation for all labor, equipment, material, staking, and incidentals necessary to satisfactorily complete the items as specified, except water, which will be paid for separately.

## Item T-904 Sodding

### DESCRIPTION

**904-1.1** This item shall consist of furnishing, hauling, and placing approved live sod on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the RPR.

### MATERIALS

**904-2.1 Sod.** Sod furnished by the Contractor shall have a good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. Sod shall be cut or stripped from living, thickly matted turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials that might be detrimental to the development of the sod or to future maintenance. At least 70% of the plants in the cut sod shall be composed of Bermuda Grass ~~the species stated in the special provisions~~, and any vegetation more than 6 inches (150 mm) in height shall be mowed to a height of 3 inches (75 mm) or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not less than that stated in the special provisions.

**904-2.2 Lime.** Lime shall be ground limestone containing not less than 85% of total carbonates, and shall be ground to such fineness that 90% will pass through a No. 20 (850  $\mu$ m) mesh sieve and 50% will pass through a No. 100 (150  $\mu$ m) mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime shall contain at least 10% of magnesium oxide. Lime shall be applied at the rate of 5 gallons per acre. All liming materials shall conform to the requirements of ASTM C602.

**904-2.3 Fertilizer.** Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified, and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

- a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
- b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
- c. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 10-10-10 commercial fertilizer and shall be spread at the rate of 500 lbs. per acre. ~~The contractor may make adjustments to the fertilizer used and the rate at which it is applied, with Engineer approval.~~

**904-2.4 Water.** The water shall be sufficiently free from oil, acid, alkali, salt, or other harmful materials that would inhibit the growth of grass.

**904-2.5 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.

## CONSTRUCTION METHODS

**904-3.1 General.** Areas to be solid, strip, or spot sodded shall be shown on the plans. Areas requiring special ground surface preparation such as tilling and those areas in a satisfactory condition that are to remain undisturbed shall also be shown on the plans.

Suitable equipment necessary for proper preparation of the ground surface and for the handling and placing of all required materials shall be on hand, in good condition, and shall be approved by the RPR before the various operations are started. The Contractor shall demonstrate to the RPR before starting the various operations that the application of required materials will be made at the specified rates.

**904-3.2 Preparing the ground surface.** After grading of areas has been completed and before applying fertilizer and limestone, areas to be sodded shall be raked or otherwise cleared of stones larger than 2 inches (50 mm) in any diameter, sticks, stumps, and other debris which might interfere with sodding, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes occurs after grading of areas and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

**904-3.3 Applying fertilizer and ground limestone.** Following ground surface preparation, fertilizer shall be uniformly spread at a rate which will provide not less than the minimum quantity of each fertilizer ingredient, as stated in the special provisions. If use of ground limestone is required, it shall then be spread at a rate that will provide not less than the minimum quantity stated in the special provisions. These materials shall be incorporated into the soil to a depth of not less than 2 inches (50 mm) by discing, raking, or other suitable methods. Any stones larger than 2 inches (50 mm) in any diameter, large clods, roots, and other litter brought to the surface by this operation shall be removed.

**904-3.4 Obtaining and delivering sod.** After inspection and approval of the source of sod by the RPR, the sod shall be cut with approved sod cutters to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than 2 inches (50 mm). Sod sections or strips shall be cut in uniform widths, not less than 10 inches (250 mm), and in lengths of not less than 18 inches (0.5 m), but of such length as may be readily lifted without breaking, tearing, or loss of soil. Where strips are required, the sod must be rolled without damage with the grass folded inside. The Contractor may be required to mow high grass before cutting sod.

The sod shall be transplanted within 24 hours from the time it is stripped, unless circumstances beyond the Contractor's control make storing necessary. In such cases, sod shall be stacked, kept moist, and protected from exposure to the air and sun and shall be kept from freezing. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. Where the soil is too dry, approval to cut sod may be granted only after it has been watered sufficiently to moisten the soil to the depth the sod is to be cut.

**904-3.5 Laying sod.** Sodding shall be performed only during the seasons when satisfactory results can be expected. Frozen sod shall not be used and sod shall not be placed upon frozen soil. Sod may be transplanted during periods of drought with the approval of the RPR, provided the sod bed is watered to moisten the soil to a depth of at least 4 inches (100 mm) immediately prior to laying the sod.

The sod shall be moist and shall be placed on a moist earth bed. Pitch forks shall not be used to handle sod, and dumping from vehicles shall not be permitted. The sod shall be carefully placed by hand, edge to edge and with staggered joints, in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward. The sod shall immediately be pressed firmly into contact with the sod bed by

tamping or rolling with approved equipment to provide a true and even surface, and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Where the sod may be displaced during sodding operations, the workmen, when replacing it, shall work from ladders or treaded planks to prevent further displacement. Screened soil of good quality shall be used to fill all cracks between sods. The quantity of the fill soil shall not cause smothering of the grass. Where the grades are such that the flow of water will be from paved surfaces across sodded areas, the surface of the soil in the sod after compaction shall be set approximately one inch (25 mm) below the pavement edge. Where the flow will be over the sodded areas and onto the paved surfaces around manholes and inlets, the surface of the soil in the sod after compaction shall be placed flush with pavement edges.

On slopes steeper than one (1) vertical to 2-1/2 horizontal and in v-shaped or flat-bottom ditches or gutters, the sod shall be pegged with wooden pegs not less than 12 inches (300 mm) in length and have a cross-sectional area of not less than 3/4 sq inch (18 sq mm). The pegs shall be driven flush with the surface of the sod.

**904-3.6 Watering.** Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner that will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface. Watering shall be per TxDOT Item 168. The rate of watering shall be as shown in the plans.

**904-3.7 Establishing turf.** The Contractor shall provide general care for the sodded areas as soon as the sod has been laid and shall continue until final inspection and acceptance of the work. All sodded areas shall be protected against traffic or other use by warning signs or barricades approved by the RPR. The Contractor shall mow the sodded areas with approved mowing equipment, depending upon climatic and growth conditions and the needs for mowing specific areas. Weeds or other undesirable vegetation shall be mowed and the clippings raked and removed from the area.

**904-3.8 Repairing.** When the surface has become gullied or otherwise damaged during the period covered by this contract, the affected areas shall be repaired to re-establish the grade and the condition of the soil, as directed by the RPR, and shall then be sodded as specified in paragraph 904-3.5.

#### METHOD OF MEASUREMENT

**904-4.1** This item shall be measured on the basis of the area in square yards (square meters) of the surface covered with sod and accepted. Watering will be measured per TxDOT Item 168.

#### BASIS OF PAYMENT

**904-5.1** This item will be paid for on the basis of the contract unit price per square yard (square meter) for sodding, which price shall be full compensation for all labor, equipment, material, staking, and incidentals necessary to satisfactorily complete the items as specified, except water, which will be paid for separately.

Payment will be made under:

Item T-904-5.1	Sodding - per square yard
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#### 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

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-904**

## Item T-905 Topsoil

### DESCRIPTION

**905-1.1** This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the RPR.

### MATERIALS

**905-2.1 Topsoil.** Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches (50 mm) or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed, but shall be thoroughly broken up and intermixed with the soil during handling operations. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means, shall be removed. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh (75  $\mu$ m) sieve as determined by the wash test in accordance with ASTM C117.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

**905-2.2 Inspection and tests.** Within 10 days following acceptance of the bid, the RPR shall be notified of the source of topsoil to be furnished by the Contractor. The topsoil shall be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. At this time, the Contractor may be required to take representative soil samples from several locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in paragraph 905-2.1.

### CONSTRUCTION METHODS

**905-3.1 General.** Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the RPR before the various operations are started.

**905-3.2 Preparing the ground surface.** Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the RPR, to a minimum depth of 2 inches (50 mm) to facilitate bonding of the topsoil to the covered subgrade soil.

The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches (50 mm) in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and compacted condition to prevent the formation of low places or pockets where water will stand.

**905-3.3 Obtaining topsoil.** Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the RPR. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as directed by the RPR. The topsoil shall be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the RPR. Any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoil purposes, shall be removed and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the airport site, the Contractor shall locate and obtain the supply, subject to the approval of the RPR. The Contractor shall notify the RPR sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

**905-3.4 Placing topsoil.** The topsoil shall be evenly spread on the prepared areas to a uniform depth of 2 inches (50 mm) after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turving operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches (50 mm) or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the RPR. The compacted topsoil surface shall conform to the required lines, grades, and cross-sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

## METHOD OF MEASUREMENT

**905-4.1** Topsoil shall be measured by the number of cubic yards (cubic meters) of topsoil measured in its final position to the thickness shown in the plans.

## BASIS OF PAYMENT

**905-5.1** Payment will be made at the contract unit price per cubic yard (cubic meter) for topsoil (obtained on the site). This price shall be full compensation for furnishing all materials and for all preparation,

placing, and spreading of the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-905-5.1                      Topsoiling (Obtained on Site) - 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                      Materials Finer than 75  $\mu\text{m}$  (No. 200) Sieve in Mineral Aggregates  
by Washing

Advisory Circulars (AC)

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

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

**END OF ITEM T-905**



## **Summary of Modifications**

### **Item L-108 Underground Power Cable for Airports**

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This modification page modifies, amplifies, or amends the technical specifications and plans. **Highlights** and **Strikethroughs** are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as **Engineer** ~~RPR~~.

Revisions to include the use of Engineer or RPR may be shown throughout the document as **Engineer** and/or **RPR**.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**108-3.3 Installation of direct-buried cable in trenches.** Unless otherwise specified, the Contractor shall not use a cable plow for installing the cable. Cable shall be unreeled uniformly in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one end. Slack cable sufficient to provide strain relief shall be placed in the trench in a series of S curves. Sharp bends or kinks in the cable shall not be permitted.

Where cables must cross over each other, a minimum of 3 inches (75 mm) vertical displacement shall be provided with the topmost cable depth at or below the minimum required depth below finished grade.

**a. Trenching.** Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored. Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of surface is disturbed. Graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 18 inches (0.5 m) below finished grade per NEC Table 300.5, except as follows:

- When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches (91 cm) unless otherwise specified.
- Minimum cable depth when crossing under a railroad track, shall be 42 inches (1 m) unless otherwise specified.

The Contractor shall excavate all cable trenches to a width not less than 6 inches (150 mm). Unless otherwise specified on the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. Flowable backfill material may alternatively be used.

Duct bank or conduit markers temporarily removed for trench excavations shall be replaced as required.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

(1) Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred.

(2) Trenching, etc., in cable areas shall then proceed, with approval of the 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 per Item P-152 ~~to a minimum of 100 percent of ASTM D1557 in unpaved areas and backfilled with controlled low strength material (CLSM) in accordance with P-153 for areas under pavement.~~

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 (150 mm) above the direct-buried cable or the counterpoise wire if present. A 3-6 inch (75 - 150 mm) wide polyethylene film detectable tape, with a metalized foil core, shall be installed above all direct buried cable or counterpoise. The tape shall be of the color and have a continuous legend as indicated on the plans. The tape shall be installed 8 inches (200 mm) minimum below finished grade.

**c. Restoration.** Following restoration of all trenching near airport movement surfaces, the Contractor shall visually inspect the area for foreign object debris (FOD) and remove any that is found. Where soil and sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by work shall be restored to its original condition. The 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 per Item P-152 ~~to a minimum of 100 percent of ASTM D1557 in unpaved areas and backfilled with controlled low strength material (CLSM) in paved areas in accordance with P-153.~~ Restoration shall be considered incidental to the pay item of which it is a component part.

## Item L-108 Underground Power Cable for Airports

### DESCRIPTION

**108-1.1** This item shall consist of furnishing and installing power cables that are direct buried and furnishing and/or installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. It includes excavation and backfill of trench for direct-buried cables only. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the RPR. This item shall not include the installation of duct banks or conduit, trenching and backfilling for duct banks or conduit, or furnishing or installation of cable for FAA owned/operated facilities.

### EQUIPMENT AND MATERIALS

#### 108-2.1 General.

**a.** Airport lighting equipment and materials covered by advisory circulars (AC) shall be approved under the Airport Lighting Equipment Certification Program per AC 150/5345-53, current version.

**b.** All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the RPR.

**c.** Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the RPR) and replaced with materials that comply with these specifications at the Contractor's cost.

**d.** All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

**e.** The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor's submittals shall be submitted electronically in PDF format. The RPR reserves the right to reject any and all equipment, materials, or procedures that do not meet the system design and the standards and codes specified in this document.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. The Contractor shall maintain a minimum insulation resistance in accordance with paragraph 108-3.10e with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period when tested in accordance with AC 150/5340-26, *Maintenance Airport Visual Aid Facilities*, paragraph 5.1.3.1, Insulation Resistance Test.

Only Third Party certified manufacturers, listed in AC 150/5345-53, Appendix 3 Addendum (as required) and meeting the BUY AMERICAN preference requirements can provide equipment and materials specified in the Contract Documents. Documentation certifying compliance with the BUY AMERICAN preference rules for Airport Improvement Program AIP cited in 49 USC §50101) shall be included with each equipment and material submittal.

**108-2.2 Cable.** Underground cable for airfield lighting facilities (runway and taxiway lights and signs) shall conform to the requirements of AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits latest edition. Conductors for use on 6.6 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #8 American wire gauge (AWG), L-824 Type C, 5,000 volts, non-shielded, with cross-linked polyethylene insulation. Conductors for use on 20 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #6 AWG, L-824 Type C, 5,000 volts, non-shielded, with cross-linked polyethylene insulation. L-824 conductors for use on the L-830 secondary of airfield lighting series circuits shall be sized in accordance with the manufacturer's recommendations. All other conductors shall comply with FAA and National Electric Code (NEC) requirements. Conductor sizes noted above shall not apply to leads furnished by manufacturers on airfield lighting transformers and fixtures.

Wire for electrical circuits up to 600 volts shall comply with Specification L-824 and/or Commercial Item Description A-A-59544A and shall be type THWN-2, 75°C for installation in conduit and RHW-2, 75°C for direct burial installations. Conductors for parallel (voltage) circuits shall be type and size and installed in accordance with NFPA-70, National Electrical Code.

Unless noted otherwise, all 600-volt and less non-airfield lighting conductor sizes are based on a 75°C, THWN-2, 600-volt insulation, copper conductors, not more than three single insulated conductors, in raceway, in free air. The conduit/duct sizes are based on the use of THWN-2, 600-volt insulated conductors. The Contractor shall make the necessary increase in conduit/duct sizes for other types of wire insulation. In no case shall the conduit/duct size be reduced. The minimum power circuit wire size shall be #12 AWG.

Conductor sizes may have been adjusted due to voltage drop or other engineering considerations. Equipment provided by the Contractor shall be capable of accepting the quantity and sizes of conductors shown in the Contract Documents. All conductors, pigtails, cable step-down adapters, cable step-up adapters, terminal blocks and splicing materials necessary to complete the cable termination/splice shall be considered incidental to the respective pay items provided.

Cable type, size, number of conductors, strand and service voltage shall be as specified in the Contract Document.

**108-2.3 Bare copper wire (counterpoise, bare copper wire ground and ground rods).** Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare solid copper wire for counterpoise and/or No. 6 AWG insulated stranded for grounding bond wire per ASTM B3 and ASTM B8 and shall be bare copper wire. For voltage powered circuits, the equipment grounding conductor shall comply with NEC Article 250.

Ground rods shall be copper-clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than 8 feet long and 5/8 inch in diameter.

**108-2.4 Cable connections.** In-line connections or splices of underground primary cables shall be of the type called for on the plans and shall be one of the types listed below. No separate payment will be made for cable connections.

**a. The cast splice.** A cast splice, employing a plastic mold and using epoxy resin equivalent to that manufactured by 3M™ Company, “Scotchcast” Kit No. 82-B, or an approved equivalent, used for potting the splice is acceptable.

**b. The field-attached plug-in splice.** Field attached plug-in splices shall be installed as shown on the plans. The Contractor shall determine the outside diameter of the cable to be spliced and furnish appropriately sized connector kits and/or adapters. Tape or heat shrink tubing with integral sealant shall be in accordance with the manufacturer’s requirements. Primary Connector Kits manufactured by Amerace, "Super Kit", Integro "Complete Kit", or approved equal is acceptable.

**c. The factory-molded plug-in splice.** Specification for L-823 Connectors, Factory-Molded to Individual Conductors, is acceptable.

**d. The taped or heat-shrink splice.** Taped splices employing field-applied rubber, or synthetic rubber tape covered with plastic tape is acceptable. The rubber tape should meet the requirements of ASTM D4388, and the plastic tape should comply with Military Specification MIL-I-24391 or Commercial Item Description A-A-55809. Heat shrinkable tubing shall be heavy-wall, self-sealing tubing rated for the voltage of the wire being spliced and suitable for direct-buried installations. The tubing shall be factory coated with a thermoplastic adhesive-sealant that will adhere to the insulation of the wire being spliced forming a moisture- and dirt-proof seal. Additionally, heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits that are designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.

In all the above cases, connections of cable conductors shall be made using crimp connectors using a crimping tool designed to make a complete crimp before the tool can be removed. All L-823/L-824 splices and terminations shall be made per the manufacturer’s recommendations and listings.

All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved equivalent, except that a light base ground clamp connector shall be used for attachment to the light base. All exothermic connections shall be made per the manufacturer’s recommendations and listings.

**108-2.5 Splicer qualifications.** Every airfield lighting cable splicer shall be qualified in making airport cable splices and terminations on cables rated at or above 5,000 volts AC. The Contractor shall submit to the RPR proof of the qualifications of each proposed cable splicer for the airport cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

**108-2.6 Concrete.** Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

**108-2.7 Flowable backfill.** Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

**108-2.8 Cable identification tags.** Cable identification tags shall be made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.

**108-2.9 Tape.** Electrical tapes shall be 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 3 feet (1 m) of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at least one foot (30 cm) vertically above the top of the access structure. This requirement also applies where primary cable passes through empty light bases, junction boxes, and access structures to allow for future connections, or as designated by the RPR.

Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans.

**108-3.2 Installation in duct banks or conduits.** This item includes the installation of the cable in duct banks or conduit per the following paragraphs. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

The Contractor shall make no connections or splices of any kind in cables installed in conduits or duct banks.

Unless otherwise designated in the plans, where ducts are in tiers, use the lowest ducts to receive the cable first, with spare ducts left in the upper levels. Check duct routes prior to construction to obtain assurance that the shortest routes are selected and that any potential interference is avoided.

Duct banks or conduits shall be installed as a separate item per Item L-110, Airport Underground Electrical Duct Banks and Conduit. The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to ensure that the duct bank or conduit is open, continuous and clear of debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, light bases, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be re-cleaned at the Contractor's expense. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

The cable shall be installed in a manner that prevents harmful stretching of the conductor, damage to the insulation, or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape providing moisture-tight mechanical protection with minimum bulk, or alternately, heat shrinkable tubing before pulling into the conduit and it shall be left sealed until connections are made. Where more than one cable is to be installed in a conduit, all cable shall be pulled in the conduit at the same time. The pulling of a cable through duct banks or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Maximum pulling tensions shall not exceed the cable manufacturer's recommendations. A non-hardening cable-pulling lubricant recommended for the type of cable being installed shall be used where required.

The Contractor shall submit the recommended pulling tension values to the RPR prior to any cable installation. If required by the RPR, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the RPR. Cable pull tensions shall be recorded by the Contractor and reviewed by the RPR. Cables exceeding the maximum allowable pulling tension values shall be removed and replaced by the Contractor at the Contractor's expense.

The manufacturer's minimum bend radius or NEC requirements (whichever is more restrictive) shall apply. Cable installation, handling and storage shall be per manufacturer's recommendations. During cold weather, particular attention shall be paid to the manufacturer's minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the RPR, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

Cable shall not be dragged across base can or manhole edges, pavement or earth. When cable must be coiled, lay cable out on a canvas tarp or use other appropriate means to prevent abrasion to the cable jacket.

**108-3.3 Installation of direct-buried cable in trenches.** Unless otherwise specified, the Contractor shall not use a cable plow for installing the cable. Cable shall be unreeled uniformly in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one end. Slack cable sufficient to provide strain relief shall be placed in the trench in a series of S curves. Sharp bends or kinks in the cable shall not be permitted.

Where cables must cross over each other, a minimum of 3 inches (75 mm) vertical displacement shall be provided with the topmost cable depth at or below the minimum required depth below finished grade.

**a. Trenching.** Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored. Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of surface is disturbed. Graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 18 inches (0.5 m) below finished grade per NEC Table 300.5, except as follows:

- When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches (91 cm) unless otherwise specified.
- Minimum cable depth when crossing under a railroad track, shall be 42 inches (1 m) unless otherwise specified.

The Contractor shall excavate all cable trenches to a width not less than 6 inches (150 mm). Unless otherwise specified on the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. Flowable backfill material may alternatively be used.

Duct bank or conduit markers temporarily removed for trench excavations shall be replaced as required.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

(1) Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred.

(2) Trenching, etc., in cable areas shall then proceed, with approval of the 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 per Item P-152 to a minimum of 100 percent of ASTM D1557 in unpaved areas and backfilled with controlled low strength material (CLSM) in accordance with P-153 for areas under pavement.

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 (150 mm) above the direct-buried cable or the counterpoise wire if present. A 3-6 inch (75 - 150 mm) wide polyethylene film detectable tape, with a metalized foil core, shall be installed above all direct buried cable or counterpoise. The tape shall be of the color and have a continuous legend as indicated on the plans. The tape shall be installed 8 inches (200 mm) minimum below finished grade.

**c. Restoration.** Following restoration of all trenching near airport movement surfaces, the Contractor shall visually inspect the area for foreign object debris (FOD) and remove any that is found. Where soil and sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by work shall be restored to its original condition. The 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 per Item P-152 ~~to a minimum of 100 percent of ASTM D1557 in unpaved areas and backfilled with controlled low strength material (CLSM) in paved areas in accordance with P 153.~~ Restoration shall be considered incidental to the pay item of which it is a component part.

**108-3.4 Cable markers for direct-buried cable.** The location of direct buried circuits shall be marked by a concrete slab marker, 2 feet (60 cm) square and 4-6 inch (10 - 15 cm) thick, extending approximately one inch (25 mm) above the surface. Each cable run from a line of lights and signs to the equipment vault shall be marked at approximately every 200 feet (61 m) along the cable run, with an additional marker at each change of direction of cable run. All other direct-buried cable shall be marked in the same manner. Cable markers shall be installed directly above the cable. The Contractor shall impress the word "CABLE" and directional arrows on each cable marking slab. The letters shall be approximately 4 inches (100 mm) high and 3 inches (75 mm) wide, with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep. Stencils shall be used for cable marker lettering; no hand lettering shall be permitted.

At the location of each underground cable connection/splice, except at lighting units, or isolation transformers, a concrete marker slab shall be installed to mark the location of the connection/splice. The Contractor shall impress the word "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. 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 contaminants prior to application.

**e. Assembly.** Surfaces of equipment or conductors being terminated or connected shall be prepared in accordance with industry standard practice and manufacturer's recommendations. All surfaces to be connected shall be thoroughly cleaned to remove all dirt, grease, oxides, nonconductive films, or other foreign material. Paints and other nonconductive coatings shall be removed to expose base metal. Clean all surfaces at least 1/4 inch (6.4 mm) beyond all sides of the larger bonded area on all mating surfaces. Use a joint compound suitable for the materials used in the connection. Repair painted/coated surface to original condition after completing the connection.

**108-3.6 Bare counterpoise wire installation for lightning protection and grounding.** If shown on the plans or included in the job specifications, bare solid #6 AWG copper counterpoise wire shall be installed for lightning protection of the underground cables. The RPR shall select one of two methods of lightning protection for the airfield lighting circuit based upon sound engineering practice and lightning strike density.

**a. Equipotential.** – [The counterpoise size is as shown on the plans. The equipotential method is applicable to all airfield lighting systems; i.e. runway, taxiway, apron – touchdown zone, centerline, edge, threshold and approach lighting systems. The equipotential method is also successfully applied to provide lightning protection for power, signal and communication systems. The light bases, counterpoise, etc – all components - are bonded together and bonded to the vault power system ground loop/electrode.

Counterpoise wire shall be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield cables. The counterpoise is centered over the cable/conduit/duct to be protected.

The counterpoise conductor shall be installed no less than 8 inches (200 mm) minimum or 12 inches (300 mm) maximum above the raceway or cable to be protected, except as permitted below:

- (1) The minimum counterpoise conductor height above the raceway or cable to be protected shall be permitted to be adjusted subject to coordination with the airfield lighting and pavement designs.
- (2) The counterpoise conductor height above the protected raceway(s) or cable(s) shall be calculated to ensure that the raceway or cable is within a 45-degree area of protection, (45 degrees on each side of vertical creating a 90 degree angle).

The counterpoise conductor shall be bonded to each metallic light base, mounting stake, and metallic airfield lighting component.

All metallic airfield lighting components in the field circuit on the output side of the constant current regulator (CCR) or other power source shall be bonded to the airfield lighting counterpoise system.

All components rise and fall at the same potential; with no potential difference, no damaging arcing and no damaging current flow.

See AC 150/5340-30, Design and Installation Details for Airport Visual Aids and NFPA 780, Standard for the Installation of Lightning Protection Systems, Chapter 11, for a detailed description of the Equipotential Method of lightning protection.

Reference FAA STD-019E, Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment, Part 4.1.1.7.]

**b. Isolation** – The counterpoise size is as shown on the plans. The isolation method is an alternate method for use only with edge lights installed in turf and stabilized soils and raceways installed parallel to and adjacent to the edge of the pavement. NFPA 780 uses 15 feet to define “adjacent to”.

The counterpoise conductor shall be installed halfway between the pavement edge and the light base, mounting stake, raceway, or cable being protected.

The counterpoise conductor shall be installed 8 inches (203 mm) minimum below grade. The counterpoise is not connected to the light base or mounting stake. An additional grounding electrode is required at each light base or mounting stake. The grounding electrode is bonded to the light base or mounting stake with a 6 AWG solid copper conductor.

See AC 150/5340-30, Design and Installation Details for Airport Visual Aids and NFPA 780, Standard for the Installation of Lightning Protection Systems, Chapter 11, for a detailed description of the Isolation Method of lightning protection.

**c. Common Installation requirements.** When a metallic light base is used, the grounding electrode shall be bonded to the metallic light base or mounting stake with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

When a nonmetallic light base is used, the grounding electrode shall be bonded to the metallic light fixture or metallic base plate with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

Grounding electrodes may be rods, ground dissipation plates, radials, or other electrodes listed in the NFPA 70 (NEC) or NFPA 780.

Where raceway is installed by the directional bore, jack and bore, or other drilling method, the counterpoise conductor shall be permitted to be installed concurrently with the directional bore, jack and bore, or other drilling method raceway, external to the raceway or sleeve.

The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet (150 m) apart around the entire circuit. The counterpoise system shall be continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode-grounding system. The connections shall be made as shown on the plans and in the specifications.

Where an existing airfield lighting system is being extended or modified, the new counterpoise conductors shall be interconnected to existing counterpoise conductors at each intersection of the new and existing airfield lighting counterpoise systems.

**d. Parallel Voltage Systems.** Provide grounding and bonding in accordance with NFPA 70, National Electrical Code.

**108-3.7 Counterpoise installation above multiple conduits and duct banks.** Counterpoise wires shall be installed above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete area of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits shall be adequate to provide a complete area of protection measured 45 degrees each side of vertical.

Where duct banks pass under pavement to be constructed in the project, the counterpoise shall be placed above the duct bank. Reference details on the construction plans.

**108-3.8 Counterpoise installation at existing duct banks.** When airfield lighting cables are indicated on the plans to be routed through existing duct banks, the new counterpoise wiring shall be terminated at ground rods at each end of the existing duct bank where the cables being protected enter and exit the duct bank. The new counterpoise conductor shall be bonded to the existing counterpoise system.

**108-3.9 Exothermic bonding.** Bonding of counterpoise wire shall be by the exothermic welding process or equivalent method accepted by the RPR. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the RPR, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

**a.** All slag shall be removed from welds.

**b.** Using an exothermic weld to bond the counterpoise to a lug on a galvanized light base is not recommended unless the base has been specially modified. Consult the manufacturer's installation directions for proper methods of bonding copper wire to the light base. See AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

**108-3.10 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 2,000 megohms for individual cable segments and not less than 50 megohms for series circuits. Verify continuity of all series airfield lighting circuits prior to energization.

f. That the insulation resistance to ground of all new non-grounded conductors of new multiple circuits or circuit segments is not less than 100 megohms.

g. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.

h. That all affected circuits (existing and new) are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.

i. That the impedance to ground of each ground rod does not exceed 25 ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test shall be used, as described by American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81, to verify this requirement. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. Test equipment and its calibration sheets shall be submitted for review and approval by the RPR prior to performing the testing.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the RPR. Where connecting new cable to existing cable, insulation resistance tests shall be performed on the new cable prior to connection to the existing circuit.

There are no approved “repair” procedures for items that have failed testing other than complete replacement.

### METHOD OF MEASUREMENT

**108-4.1** 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 (meters) installed and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate measurements shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. The measurement for this item shall include additional quantities required for slack.

**108-4.3** No separate payment will be made for ground rods.

### BASIS OF PAYMENT

**108-5.1** Payment will be made at the contract unit price for trenching, cable and bare counterpoise wire installed in trench (direct-buried), or cable and equipment ground installed in duct bank or conduit, in place by the Contractor and accepted by the RPR. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

Payment will be made under:

Item L-108-5.1	No. 8 AWG, 5kV, L-824, Type C Cable, Installed in Conduit – per linear foot
Item L-108-5.2	No. 6 AWG, Solid, Bare Copper Counterpoise Wire, Installed in Trench, Including Connections/Terminations - per linear foot
Item L-108-5.3	No. 6 AWG, Solid, Bare Copper Counterpoise Wire, Installed Above the Duct Bank or Conduit, Including Connections/Terminations - per linear foot
Item L-108-5.3	Remove Existing No. 8 AWG, L-824, Type C Cable, Installed in 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 Circulars (AC)

AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-53	Airport Lighting Equipment Certification Program

## Commercial Item Description

A-A-59544A Cable and Wire, Electrical (Power, Fixed Installation)  
 A-A-55809 Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic

## ASTM International (ASTM)

ASTM B3 Standard Specification for Soft or Annealed Copper Wire  
 ASTM B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft  
 ASTM B33 Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes  
 ASTM D4388 Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes

## Mil Spec

MIL-PRF-23586F Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical  
 MIL-I-24391 Insulation Tape, Electrical, Plastic, Pressure Sensitive

## National Fire Protection Association (NFPA)

NFPA-70 National Electrical Code (NEC)  
 NFPA-780 Standard for the Installation of Lightning Protection Systems

## American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

ANSI/IEEE STD 81 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

## Federal Aviation Administration Standard

FAA STD-019E Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment

**END OF ITEM L-108**



## Item L-110 Airport Underground Electrical Duct Banks and Conduits

### DESCRIPTION

**110-1.1** This item shall consist of underground electrical conduits and duct banks (single or multiple conduits encased in concrete or buried in sand) installed per this specification at the locations and per the dimensions, designs, and details shown on the plans. This item shall include furnishing and installing of all underground electrical duct banks and individual and multiple underground conduits. It shall also include all ~~turfing~~ trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.

### EQUIPMENT AND MATERIALS

#### 110-2.1 General.

**a.** All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the RPR.

**b.** Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the ~~Engineer RPR~~. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the ~~Engineer 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 ~~Engineer 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 ~~Engineer 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 ~~Engineer 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 final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

**110-2.2 Steel conduit.** Rigid galvanized steel (RGS) conduit and fittings shall be hot dipped galvanized inside and out and conform to the requirements of Underwriters Laboratories Standards 6, 514B, and 1242. All RGS conduits or RGS elbows installed below grade, in concrete, permanently wet locations or other similar environments shall be painted with a 10-mil thick coat of asphaltum sealer or shall have a factory-bonded polyvinyl chloride (PVC) cover. Any exposed galvanizing or steel shall be coated with 10 mils of asphaltum sealer. When using PVC coated RGS conduit, care shall be exercised not to damage the factory PVC coating. Damaged PVC coating shall be repaired per the manufacturer's written instructions. In lieu of PVC coated RGS, corrosion wrap tape shall be permitted to be used where RGS is in contact with direct earth."

**110-2.3 Plastic conduit.** Plastic conduit and fittings shall conform to the following requirements:

- UL 514B covers W-C-1094-Conduit fittings all types, classes 1 thru 3 and 6 thru 10.<sup>[1]</sup>
- UL 514C covers W-C-1094- all types, Class 5 junction box and cover in plastic (PVC).
- UL 651 covers W-C-1094-Rigid PVC Conduit, types I and II, Class 4.
- UL 651A covers W-C-1094-Rigid PVC Conduit and high-density polyethylene (HDPE) Conduit type III and Class 4.

Underwriters Laboratories Standards UL-651 and Article 352 of the current National Electrical Code shall be one of the following, as shown on the plans:

- a. Type I—Schedule 40 and Schedule 80 PVC suitable for underground use either direct-buried or encased in concrete.
- b. Type II—Schedule 40 PVC suitable for either above ground or underground use.
- c. Type III – Schedule 80 PVC suitable for either above ground or underground use either direct-buried or encased in concrete.
- d. Type III –HDPE pipe, minimum standard dimensional ratio (SDR) 11, suitable for placement with directional boring under pavement.

The type of solvent cement shall be as recommended by the conduit/fitting manufacturer.

**110-2.4 Split conduit.** Split conduit shall be pre-manufactured for the intended purpose and shall be made of steel or plastic.

**110-2.5 Conduit spacers.** Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads. They shall be designed to accept No. 4 reinforcing bars installed vertically.

**110-2.6 Concrete.** Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

**110-2.7 Precast concrete structures.** Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program. Precast concrete structures shall conform to ASTM C478.

**110-2.8 Flowable backfill.** Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

**110-2.9 Detectable warning tape.** Plastic, detectable, American Public Works Association (APWA) red (electrical power lines, cables, conduit and lighting cable), orange (telephone/fiber optic cabling) with continuous legend magnetic tape shall be polyethylene film with a metallized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item.

## CONSTRUCTION METHODS

**110-3.1 General.** The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The 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 not be less than 18 inches (0.5 m) below finished grade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch (6 mm) smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

The Contractor shall swab out all conduits/ducts and clean base can, manhole, pull boxes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed the light bases, manholes, pull boxes, etc., and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200-pound (90 kg) test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet (1.5 m).

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch (6.3 mm) sieve. Flowable backfill may alternatively be used.

Underground electrical warning (Caution) tape shall be installed in the trench above all underground duct banks and conduits in unpaved areas. Contractor shall submit a sample of the proposed warning tape for approval by the RPR. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (60 cm).

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the RPR, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the RPR.

All excavation shall be unclassified and shall be considered incidental to Item L-110. Dewatering necessary for duct installation, and erosion per federal, state, and local requirements is incidental to Item L-110.

Unless otherwise specified, excavated materials that are deemed by the RPR to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the RPR and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

b. Trenching, etc., in cable areas shall then proceed with approval of the RPR, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

**110-3.2 Duct banks.** Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches (0.5 m) below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans,

all duct banks shall be placed on a layer of concrete not less than 3 inches (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 inches (75 mm) apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches (75 mm) thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot (1.5-m) intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the RPR shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the RPR.

**110-3.3 Conduits without concrete encasement.** Trenches for single-conduit lines shall be not less than 6 inches (150 mm) nor more than 12 inches (300 mm) wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch (6.3 mm) sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport's secured area where trespassing is prohibited are at least 18 inches (0.5 m) below the finished grade. Conduits outside the Airport's secured area shall be installed so that the tops of the conduits are at least 24 inches (60 cm) below the finished grade per National Electric Code (NEC), Table 300.5.

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6

inches (150 mm) apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

**110-3.4 Markers.** 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.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

**110-3.6 Backfilling for duct banks.** After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the requirements of Item P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet (76 m) of duct bank or one work period's construction, whichever is less.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

**110-3.7 Restoration.** Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The 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.** Cable removed shall be the property of the contractor and shall be legally disposed of.

### METHOD OF MEASUREMENT

**110-4.1** Underground conduits and duct banks shall be measured by the linear feet (meter) of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated material, and restoration, and for drain lines, the termination at the drainage structure, all measured in place, completed, and accepted. Separate measurements shall be made for the various types and sizes.

### BASIS OF PAYMENT

**110-5.1** Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for removal and disposal of existing duct banks and conduits as shown on the plans, furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item per the provisions and intent of the plans and specifications.

Payment will be made under:

Item L-110-5.1	2" PVC Schedule 40 Conduit in Trench – per linear foot
Item L-110-5.2	2-2" PVC Schedule 40 Conduit, Concrete Encased – per linear foot

### REFERENCES

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

Advisory Circular (AC)

AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-53	Airport Lighting Equipment Certification Program

ASTM International (ASTM)

ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
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## 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**

## **Summary of Modifications**

### **Item L-115 Electrical Manholes and Junction Structures**

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This modification page modifies, amplifies, or amends the technical specifications and plans. **Highlights** and **Strikethroughs** are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as **Engineer** ~~RPR~~.

Revisions to include the use of Engineer or RPR may be shown throughout the document as **Engineer** and/or ~~RPR~~.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

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**115-3.1 Unclassified excavation.** It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Damage to utility lines, through lack of care in excavating, shall be repaired or replaced to the satisfaction of the **Engineer** ~~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 **Engineer** ~~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 **Engineer** ~~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 **Engineer** ~~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.



## Item L-115 Electrical Manholes and Junction Structures

### DESCRIPTION

**115-1.1** This item shall consist of electrical manholes and junction structures (hand holes, pull boxes, junction cans, etc.) installed per this specification, at the indicated locations and conforming to the lines, grades and dimensions shown on the plans or as required by the Engineer 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 Engineer RPR including removal of existing manholes and junction structures as shown on the plans.

### EQUIPMENT AND MATERIALS

#### 115-2.1 General.

**a.** All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer 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 Engineer 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 Engineer 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 Engineer 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 Engineer 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 100,000 lb aircraft loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.

Threaded inserts and pulling eyes shall be cast in as shown on the plans.

If the Contractor chooses to propose a different structural design, signed and sealed shop drawings, design calculations, and other information requested by the Engineer RPR shall be submitted by the Contractor to allow for a full evaluation by the Engineer RPR. The Engineer RPR shall review per the process defined in the General Provisions.

**115-2.4 Junction boxes.** Junction boxes shall be L-867 Class 1 (non-load bearing) or L-868 Class 1 (load bearing) airport light bases that are encased in concrete. The light bases shall have a L-894 blank cover, gasket, and stainless steel hardware. All bolts, studs, nuts, lock washers, and other similar fasteners used for the light fixture assemblies must be fabricated from 316L (equivalent to EN 1.4404), 18-8, 410, or 416 stainless steel. If 18-8, 410, or 416 stainless steel is utilized it shall be passivated and be free from any discoloration. Covers shall be 3/8-inch (9-mm) thickness for L-867 and 3/4-inch (19-mm) thickness for L-868. All junction boxes shall be provided with both internal and external ground lugs.

**115-2.5 Mortar.** The mortar shall be composed of one part of cement and two parts of mortar sand, by volume. The cement shall be per the requirements in ASTM C150, Type I. The sand shall be per the requirements in ASTM C144. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15% of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C206. Water shall be potable, reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product.

**115-2.6 Concrete.** Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

**115-2.7 Frames and covers.** The frames shall conform to one of the following requirements:

- a. ASTM A48 Gray iron castings
- b. ASTM A47 Malleable iron castings
- c. ASTM A27 Steel castings
- d. ASTM A283, Grade D Structural steel for grates and frames
- e. ASTM A536 Ductile iron castings
- f. ASTM A897 Austempered ductile iron castings

All castings specified shall withstand a maximum tire pressure of 216 psi and maximum load of 90,000 lbs.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover unit shall be provided with fastening members to prevent it from being dislodged by traffic, but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

Each cover shall have the word "ELECTRIC" or other approved designation cast on it. Each frame and cover shall be as shown on the plans or approved equivalent. No cable notches are required.

Each manhole shall be provided with a "DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" safety warning sign as detailed in the Contract Documents and in accordance with OSHA 1910.146 (c)(2).

**115-2.8 Ladders.** Ladders, if specified, shall be galvanized steel or as shown on the plans.

**115-2.9 Reinforcing steel.** All reinforcing steel shall be deformed bars of new billet steel meeting the requirements of ASTM A615, Grade 60.

**115-2.10 Bedding/special backfill.** Bedding or special backfill shall be as shown on the plans.

**115-2.11 Flowable backfill.** Flowable material used to backfill shall conform to the requirements of Item P-153, Controlled Low Strength Material.

**115-2.12 Cable trays.** Cable trays shall be of galvanized steel. Cable trays shall be located as shown on the plans.

**115-2.13 Plastic conduit.** Plastic conduit shall comply with Item L-110, Airport Underground Electrical Duct Banks and Conduits.

**115-2.14 Conduit terminators.** Conduit terminators shall be pre-manufactured for the specific purpose and sized as required or as shown on the plans.

**115-2.15 Pulling-in irons.** Pulling-in irons shall be manufactured with 7/8-inch (22 mm) diameter hot-dipped galvanized steel or stress-relieved carbon steel roping designed for concrete applications (7 strand, 1/2-inch (12 mm) diameter with an ultimate strength of 270,000 psi (1862 MPa)). Where stress-relieved carbon steel roping is used, a rustproof sleeve shall be installed at the hooking point and all exposed surfaces shall be encapsulated with a polyester coating to prevent corrosion.

**115-2.16 Ground rods.** Ground rods shall be one piece, copper clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 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 Engineer 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 Engineer 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 Engineer 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 Engineer 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 Engineer 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 Engineer 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 **Engineer RPR** may direct the Contractor to delay the removal of sheeting and bracing if, in his judgment, the installed work has not attained the necessary strength to permit placing of backfill.

**115-3.7 Backfilling.** After a structure has been completed, the area around it shall be backfilled in horizontal layers not to exceed 6 inches (150 mm) in thickness measured after compaction to the density requirements in Item P-152. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the **Engineer RPR**.

Backfill shall not be placed against any structure until approval is given by the **Engineer 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 **Engineer RPR** may direct the Contractor to add, at his own expense, sufficient water during compaction to assure a complete consolidation of the backfill. The Contractor shall be responsible for all damage or injury done to conduits, duct banks, structures, property or persons due to improper placing or compacting of backfill.

**115-3.8 Connection of duct banks.** To relieve stress of joint between concrete-encased duct banks and structure walls, reinforcement rods shall be placed in the structure wall and shall be formed and tied into duct bank reinforcement at the time the duct bank is installed.

**115-3.9 Grounding.** A ground rod shall be installed in the floor of all concrete structures so that the top of rod extends 6 inches (150 mm) above the floor. The ground rod shall be installed within one foot (30 cm) of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor shall drill a 4-inch (100 mm) diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod.

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of one foot (30 cm) above the floor of the structure and separate from other cables. No. 2 American wire gauge (AWG) bare copper pigtailed shall bond the grounding bus to all cable trays and other metal hardware within the concrete structure. Connections to the grounding bus shall be exothermic. If an exothermic weld is not possible, connections to the grounding bus shall be made by using connectors approved for direct burial in soil or concrete per UL 467. Hardware connections may be mechanical, using a lug designed for that purpose.

**115-3.10 Cleanup and repair.** After erection of all galvanized items, damaged areas shall be repaired by applying a liquid cold-galvanizing compound per MIL-P-21035. Surfaces shall be prepared and compound applied per the manufacturer's recommendations.

Prior to acceptance, the entire structure shall be cleaned of all dirt and debris.

**115-3.11 Restoration.** After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. The Contractor shall restore all disturbed areas equivalent to or better than their original condition. All sodding, grading and restoration shall be considered incidental to the respective Item L-115 pay item.

The Contractor shall grade around structures as required to provide positive drainage away from the structure.

Areas with special surface treatment, such as roads, sidewalks, or other paved areas shall have backfill compacted to match surrounding areas, and surfaces shall be repaired using materials comparable to original materials.

Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

After all work is completed, the Contractor shall remove all tools and other equipment, leaving the entire site free, clear and in good condition.

**115-3.12 Inspection.** Prior to final approval, the electrical structures shall be thoroughly inspected for conformance with the plans and this specification. Any indication of defects in materials or workmanship shall be further investigated and corrected. The earth resistance to ground of each ground rod shall not exceed 25 ohms. Each ground rod shall be tested using the fall-of-potential ground impedance test per American National Standards Institute / Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81. This test shall be performed prior to establishing connections to other ground electrodes.

**115-3.13 Manhole elevation adjustments.** 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

## 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.

Payment will be made under:

Item L-115-5.1            L-867D Hand Hole, Including Concrete Encasement - 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**

## Summary of Modifications

### Item L-125 Installation of Airport Lighting Systems

This modification page modifies, amplifies, or amends the technical specifications and plans. Highlights and Strikethroughs are used to identify modifications to original specification. In the event of discrepancy, this modification shall take precedence over the plans and the technical specifications.

Revisions for the use of Engineer in lieu of Resident Project Representative (RPR) may be shown throughout the document as Engineer RPR.

Revisions to include the use of Engineer or RPR may be shown throughout the document as Engineer and/or RPR.

The changes above related to the Engineer and RPR are not shown in the modification sheet.

**125-2.7 Runway and Taxiway Lights.** Existing taxiway lights are to be removed and reinstalled in new cans. Runway and taxiway lights shall conform to the requirements of AC 150/5345-46. Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors conforming to the specification for the light concerned or to the standard referenced.

#### Lights

Type	Class	Mode	Style	Option	Base	Filter	Transformer	Notes

**125-2.8 Runway and Taxiway Signs.** Runway and Taxiway Guidance Signs should conform to the requirements of AC 150/5345-44. Not required

#### Signs

Type	Size	Style	Class	Mode	Notes



## Item L-125 Installation of Airport Lighting Systems

### DESCRIPTION

**125-1.1** This item shall consist of airport lighting systems furnished and installed in accordance with this specification, the referenced specifications, and the applicable advisory circulars (ACs). The systems shall be installed at the locations and in accordance with the dimensions, design, and details shown in the plans. This item shall include the furnishing of all equipment, materials, services, and incidentals necessary to place the systems in operation as completed units to the satisfaction of the Engineer RPR.

### EQUIPMENT AND MATERIALS

#### 125-2.1 General.

**a.** Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified under the Airport Lighting Equipment Certification Program in accordance with AC 150/5345-53, current version. FAA certified airfield lighting shall be compatible with each other to perform in compliance with FAA criteria and the intended operation. If the Contractor provides equipment that does not perform as intended because of incompatibility with the system, the Contractor assumes all costs to correct the system for to operate properly.

**b.** Manufacturer's certifications shall not relieve the Contractor of their responsibility to provide materials in accordance with these specifications and acceptable to the Engineer RPR. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the Engineer 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 Engineer 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 Engineer 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 Engineer RPR reserves the right to reject any or all equipment, materials or procedures, which, in the Engineer RPR's opinion, does not meet the system design and the standards and codes, specified herein.

**e.** All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least 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.

## 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** Not required.

**125-2.7 Runway and Taxiway Lights.** Existing taxiway lights are to be removed and reinstalled in new cans. Runway and taxiway lights shall conform to the requirements of AC 150/5345-46. Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors conforming to the specification for the light concerned or to the standard referenced.

### Lights

Type	Class	Mode	Style	Option	Base	Filter	Transformer	Notes

**125-2.8 Runway and Taxiway Signs.** Runway and Taxiway Guidance Signs should conform to the requirements of AC 150/5345-44. Not required

### Signs

Type	Size	Style	Class	Mode	Notes

**125-2.9 Runway End Identifier Light (REIL).** Not required.

**125-2.10 Precision Approach Path Indicator (PAPI).** Not required.

**125-2.11 Circuit Selector Cabinet.** Not required.

**125-2.12 Light Base and Transformer Housings.** Light Base and Transformer Housings should conform to the requirements of AC 150/5345-42. Light bases shall be Type L-867, Class 1A, Size B shall be provided as indicated or as required to accommodate the fixture or device installed thereon. Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures.

**125-2.13 Isolation Transformers.** Isolation Transformers shall be Type L-830, size as required for each installation. Transformer shall conform to AC 150/5345-47.

## INSTALLATION

**125-3.1 Installation.** The Contractor shall furnish, install, connect and test all equipment, accessories, conduit, cables, wires, buses, grounds and support items necessary to ensure a complete and operable airport lighting system as specified here and shown in the plans.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and state and local code agencies having jurisdiction.

The Contractor shall install the specified equipment in accordance with the applicable advisory circulars and the details shown on the plans.

**125-3.2 Testing.** All lights shall be fully tested by continuous operation for not less than 24 hours as a completed system prior to acceptance. The test shall include operating the constant current regulator in each step not less than 10 times at the beginning and end of the 24-hour test. The fixtures shall illuminate properly during each portion of the test.

**125-3.3 Shipping and Storage.** Equipment shall be shipped in suitable packing material to prevent damage during shipping. Store and maintain equipment and materials in areas protected from weather and physical damage. Any equipment and materials, in the opinion of the RPR, damaged during construction or storage shall be replaced by the Contractor at no additional cost to the owner. Painted or galvanized surfaces that are damaged shall be repaired in accordance with the manufacturer's recommendations.

**125-3.4 Elevated 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.

**125-3.4 Removal of Base Mounted Light and Can.** Existing lights and transformers are to be removed for re-installation. Once light and transformer are removed, existing cans shall be removed. Any lights removed that aren't required for re-installation shall be turned over to the Airport. All other removed materials shall be disposed of off-site.

## METHOD OF MEASUREMENT

**125-4.1** Reflective markers will be measured by the number installed as completed units in place, ready for operation, and accepted by the RPR. 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 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 shall be measured by each system installed as a completed unit in place, ready for operation, and accepted by the RPR. Removed lights/transformers and cans will be measured by the number of each removed.

Precision Approach Path Indicator shall be measured by each system installed as a completed unit, in place, ready for operation, and accepted by the RPR. Abbreviated Precision Approach Path Indicator 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, precision approach path indicator, or abbreviated precision approach path indicator installed by the Contractor and accepted by the RPR. Payment will be made at the contract unit price for each light/transformer and can removed. This payment will be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Item L-125-5.1	Remove and Salvage Existing Taxiway Edge Light and Transformer – per each
Item L-125-5.2	Remove Existing Concrete Encased Light Can – per each
Item L-125-5.2	Reinstall Existing Taxiway Edge Light and Transformer and New Base Can Encased in Concrete – 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
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**END OF ITEM L-125**

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# Item 168

## Vegetative Watering



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**1. DESCRIPTION**

Provide and distribute water to promote growth of vegetation as directed.

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**2. MATERIALS**

Use water that is clean and free of industrial wastes and other substances harmful to the growth of vegetation.

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**3. CONSTRUCTION**

Apply water when directed. Furnish and operate equipment to distribute water at a uniform and controllable rate. Ensure that watering does not erode soil or plantings. Apply water in the required quantity where shown on the plans or as directed.

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**4. MEASUREMENT**

This Item will be measured by the 1,000 gal. (MG) of water as applied.

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**5. PAYMENT**

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Vegetative Watering." This price is full compensation for furnishing and operating watering equipment and measuring devices and for furnishing and applying water, including hauling, equipment, labor, and incidentals.

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## ITEM KSA-100 PROJECT SCHEDULE AND MOBILIZATION

### DESCRIPTION

**100-1.1** The work covered by this section consists of preparatory work and operations, including but not limited to those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings, and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site.

This item shall also cover the mandatory project schedule to be updated and provided to the Engineer, as described herein.

**100-1.2 PROJECT SCHEDULE.** A complete project schedule shall be provided by the Contractor at the Pre-Construction meeting and shall be explained by the Contractor to the meeting attendees. Any necessary runway and /or taxiway shutdown dates may be determined at the Pre-Construction meeting, or at a later time, as approved by the airport manager and coordinated by the Resident Project Representative.

Interim project schedules shall include the following, as necessary:

- a. Original baseline schedule;
- b. Updated schedule to current construction activity;
- c. Adjusted critical path; and
- d. Adjusted runway and/or taxiway shutdown dates.

The Engineer, at their discretion, may request a monthly updated interim project schedule. If requested, the corresponding month's pay request will not be processed until the updated interim project schedule has been submitted to the Engineer. Any delay in the Engineer receiving the updated interim project schedule will cause a delay in processing that month's pay request. Refer to the General Notes as shown on the plans for any additional requirements.

**100-1.3 STAGING AREA.** The area designated on the plans as the Contractor's staging area, including ingress and egress to the construction site, shall be prepared for the storage of equipment and supplies. This shall include, but not be limited to, grading, gates (for the Contractor's equipment and supplies), power supply, telephone service, field offices, etc., necessary for the Contractor to perform his responsibilities as required by the Contract. Restoring the site to pre-project conditions by grading and establishing grass shall be included in this item. The installation of a safety fence around the perimeter of the staging areas shall also be included in this bid item, as necessary.

**100-1.4 RPR FIELD OFFICE.** Not Used.

**100-1.5 ADDITIONAL REQUIREMENTS.** Contractor shall provide a portable hand-held aviation band radio for use by the RPR.

Refer to the General Notes as shown on the plans for additional requirements.

#### **METHOD OF MEASUREMENT**

**100-2.1** The work in this item will not be measured separately for payment, but shall be considered subsidiary to Item C-105 of the specifications.

#### **BASIS OF PAYMENT**

**100-3.1** The work in this item will not be paid for separately, but will be considered subsidiary to Item C-105 Mobilization.

**END OF ITEM 100**

## ITEM KSA-101 SHOP DRAWINGS, PROJECT DATA, AND SAMPLES

### DESCRIPTION

**101-1.1** Contractor shall furnish all labor, materials, tools, equipment, and perform all work and services necessary for or incidental to the furnishing, processing, delivery, reproduction and other necessary functions incidental to scheduling and handling of shop drawings, project data, and samples as indicated on the plans and/or as specified, in accordance with provisions of the Contract Documents, and completely coordinated with work of all trades.

- a. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for completion of work under this item shall be furnished and performed as part of this item.
- b. See appropriate sections for specific items for which data and/or samples are required.

**101-2.1 SUBMITTAL, ADDRESS.** All items shall be submitted electronically. The preferred method of submission is utilizing the Newforma Info Exchange project page provided by KSA. KSA will provide a link to the project page for the Contractor to make submittals, to submit RFI's, and upload large files as necessary. There is no cost for using this service. Submittals made via Newforma shall be sent to **Chad Pennel, PE** at [cpennel@ksaeng.com](mailto:cpennel@ksaeng.com), and **Arjay Lopez** at [alopez@ksaeng.com](mailto:alopez@ksaeng.com).

### **101-3.1 SUBMITTALS, GENERAL.**

- a. Contractor shall be responsible for and make all submissions. All items shall be transmitted electronically and include a Contractor's review stamp.
- b. Each transmittal will be sequentially numbered starting with No. 1.
  - (1) An item that is resubmitted will retain the original number but with an added suffix starting with A.
  - (2) Only one specification division should be covered by one letter of transmission.
  - (3) Sufficient catalog information together with catalog cuts and technical data must be submitted to allow an evaluation to be made to determine whether or not the item in question is acceptable.
- c. No submittals will be returned to subcontractors. Submittals transmitted to the Engineer by anyone other than the Prime Contractor will be returned to the Prime Contractor.
- d. Submit items sufficiently in advance of date required to allow reasonable time for review, and to allow for resubmission if necessary. Items submitted without Contractor's approval stamp will be returned, without action, for resubmission. Items that are not submitted in accord with the provisions of this item will be returned, without action, for resubmission.
- e. Operation and Maintenance Manuals, and/or warranties, where required, shall be a separate transmittal.

**101-4.1 SUBMITTALS, SHOP DRAWINGS PROCEDURE.**

- a. Submit as indicated above. Identify submittals as to manufacturer, item, use, type, project designation, specification section or drawing detail reference, and other pertinent information.
- b. Submit an electronic copy of each submittal until approval is obtained.
- c. Allow clear space for stamping on right hand side. Contractor shall stamp his approval on drawings prior to submission to Engineer as indication of his checking and verification of dimensions and coordination with interrelated items. Marks on submittals by Contractor shall not be in red.
- d. Submit standard items like equipment brochures, cuts of fixtures, or standard catalog items (reproducible not required). Indicate exact item or model and all proposed options. Include scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, controls, and other pertinent data.

**101-5.1 SUBMITTALS, SAMPLES.**

- a. Submit to address indicated above. Identify submittals as to manufacturer, item, use, type, project designation, specification section of drawing detail reference, and other pertinent information.
- b. Forward with transmittal letters. Include brochures, shop drawings, and installation instruction. Contractor shall stamp his approval on drawings prior to submission to Engineer as indication of his checking and verification of dimensions and coordination with interrelated items. Resubmit samples of rejected items.
- c. Approved samples submitted or constructed, constitute criterion for judging completed work. Finished work or items not equal to samples will be rejected.
- d. Samples will be retained for comparison purposes and/or the Contractor shall remove samples as directed. Contractor shall pay all costs of furnishing and removing samples.

**101-6.1 SUBMITTALS, APPROVAL OR REJECTION.**

- a. Transmittals returned with Approval are considered ready for fabrication and/or installation. If for any reason a transmittal that has an A or B approval is resubmitted, it must be accompanied by a letter pointing out the changes that have been made and the reason for the re-submittal. It shall be the Contractor's responsibility to assure that the previously approved documents are destroyed when they are superseded by a re-submittal as such.
- b. Transmittals with approval combined with Action "Revise and Resubmit" or "Rejected" will be individually analyzed giving consideration as follows:
  - (1) If the items or system proposed is acceptable and the majority of the major individual components (Drawings or Documents) are in compliance; however, there are some minor items not in compliance. The portion of the transmittal given "Revise and Resubmit" or "Rejected" will not be distributed (unless previously agreed to otherwise). Copies of the "Revise and Resubmit" or "Rejected" drawings will be marked up and returned to the

Contractor electronically. It shall be the Contractor's responsibility to insure that these items are corrected and resubmitted.

- (2) If the items or system proposed are acceptable; however, the major part of the individual drawings or documents are incomplete or require revision, the entire submittal will be given "Revise and Resubmit" or "Rejected" action. Again, it is reiterated that this is at the sole discretion of the Engineer and some drawings may contain relatively few or no comments for the statement, "Resubmit" to maintain a complete package. Distribution to the Owner and field will not be made unless previously agreed to otherwise.
- (3) Approval is general and does not permit departure from Contract Documents; relieve Contractor from responsibility for errors in detail, dimensions or related items; approve departure from previous instructions or details; components, wiring, etc., required to make item operational or usable.
- (4) Manufacture or fabrication of items prior to final approval is at Contractor's own risk.

**101-7.1 REQUIRED SHOP DRAWINGS, CERTIFICATE, OR REPORTS.** Shop drawings, certificate, or reports shall be submitted on the following items, as appropriate, for approval. The following list is not considered all-inclusive. The Contractor shall supply all submittals required by the plans and specifications.

- |  |  |
|--|--|
| <b>a.</b> Concrete Mix Design for each class of concrete used                            | <b>h.</b> Erosion Control Materials                              |
| <b>b.</b> Reinforcing Steel  | <b>i.</b> Precast Headwalls and/or Safety End Treatments         |
| <b>c.</b> Sod, Fertilizer, Hydromulch, Lime, and Nutrients Certificates                  | <b>j.</b> Pavement Paint Certificates                            |
| <b>d.</b> Joint Sealing Materials (Backer Rods, Sealants & Expansion Material)           | <b>k.</b> Drainage Pipe  |
| <b>e.</b> Glass Beads for Pavement Markings  | <b>l.</b> Pipe Bedding Material                                  |
| <b>f.</b> Aggregate Samples and Test Results for Crushed Aggregate Base Material         | <b>m.</b> Storm Water Pollution Prevention Plan (Not for Review) |
| <b>g.</b> Lime Certificates and Data for Material to be Used in Lime Stabilized Subgrade | <b>n.</b> Electrical Components                                  |

**END OF ITEM 101**

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## ITEM KSA-109 SAFETY AND SECURITY

### DESCRIPTION

**109-1.1** All work shall comply with the Construction Safety & Phasing Plan (CSPP), included as an appendix, and incorporated into this contract. Required reference material associated with this item includes:

FAA AC 150/5200-18 (Latest Edition), Airport Safety Self-Inspection  
FAA AC 150/5210-5 (Latest Edition), Painting, Marking and Lighting of Vehicles Used on an Airport  
FAA AC 150/5370-2 (Latest Edition), Operational Safety on Airports During Construction

Copies of these FAA documents are available at [https://www.faa.gov/airports/resources/advisory\\_circulars/](https://www.faa.gov/airports/resources/advisory_circulars/).

The work covered by this section consists of furnishing all materials, equipment, and labor and performing all necessary operations to comply with the phasing plans and CSPP, including, but not limited to, all barricades, marking and lighting associated with construction safety and phasing and traffic control.

**109-1.2 BARRICADES AND MARKINGS FOR PAVEMENT CLOSURE.** Proper marking, barricading and lighting of areas on the airfield associated with the construction shall be the responsibility of the Contractor. This will include properly marking, barricading and lighting closed runways, taxiways, taxilanes, and aprons, the limits of construction, critical areas on the airfield, material storage areas, equipment storage areas, haul routes, parking areas and other areas defined as required for the Contractor's exclusive use. The Contractor shall erect and maintain around the perimeter of these areas suitable marking and warning devices visible for day and night use. Temporary barricades, flagging, and flashing warning lights shall be required at critical access points. The type and location of marking and warning devices will be approved by the Engineer. The Contractor shall be responsible for maintaining the barricades, lights, markings in their proper location, in good working order, and clean for 24 hours per day throughout the contract period.

The Contractor may be required to remove barricades and runway or taxiway closure markings at the end of work period and to reinstall the same prior to recommencing work in the previously barricaded area.

Special emphasis shall be given to open trenches, excavations, heavy equipment marshalling areas, and stockpiled material located in the airport operations area, which shall be predominantly marked by the Contractor with flags and lighted by approved light units during hours of restricted visibility and darkness.

When allowed for in the plans, when the Contractor completes one operation (e.g. pavement removal) in a phase that requires closure of adjacent active airfield pavement, they may continue with this same operation in other phases once the safety area is reestablished, as shown in the plans, and the adjacent closed airfield pavement is re-opened.

**109-1.5 SAFETY PLAN COMPLIANCE DOCUMENT.** Preparation of the Safety Plan Compliance Document (SPCD), as required by AC 150/5370-2G *Operational Safety on Airports During Construction*, will be included under this section. A template that may be utilized by the contractor in preparing the SPCD is included at the end of this Item.

### METHOD OF MEASUREMENT

**109-2.1 Measurement** for "Barricades and Markings for Pavement Closure" will be by lump sum as the work progresses. This item includes all barricades, lighting and markings required for pavement closures and other areas as identified in this specification.

**109-2.2** Measurement for “Preparation of the Safety Plan Compliance Document” will be by lump sum.

**109-2.3** Any work identified in this item for which there is not a specific pay item will not be measured for payment but shall be considered subsidiary to other items in the contract.

**BASIS OF PAYMENT**

**109-3.1** All work performed, and materials furnished as prescribed in this item shall be measured and paid for at the contract lump sum price for “Barricades and Markings for Pavement Closure”, and “Preparation of Safety Plan Compliance Document.”

The lump sum for “Barricades and Markings for Pavement Closure” shall be paid pro-rata per month and the monthly amount shall be calculated by dividing the lump sum by the contract time in months. The final payment for “Barricades and Markings” shall not be made until all substantial work has been completed by the Contractor, as determined by the engineer, and the Contractor has demobilized from the project site.

The lump sum for “Preparation of the Safety Plan Compliance Document” shall be paid for upon completion and acceptance of the SPCD.

These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, removal, and installation of materials; and for all labor, equipment, tools, and incidentals necessary to complete the items.

Payment will be made under:

KSA 109-3.1	Barricades and Markings for Pavement Closure	Per lump sum
KSA 109-3.2	Preparation of the Safety Plan Compliance Document	Per lump sum

**END OF ITEM KSA-109**

# Safety Plan Compliance Document (SPCD)

PROJECT NAME:

CONTRACTOR:

POINT OF CONTACT:

CONTACT PHONE:

**LOCATION OF CSPP AND SPCD:** Contractor shall have copies of the CSPP and SPCD available at all times for reference by the airport operator and its representatives, and by subcontractors and contractor employees.

Location of CSPP and SPCD: \_\_\_\_\_

**EMERGENCY CONTACTS:** Provide a point of contact that will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport. Project will require 24-hour coverage.

Primary Point of Contact: \_\_\_\_\_ Phone: \_\_\_\_\_

Secondary Point of Contact: \_\_\_\_\_ Phone: \_\_\_\_\_

**SAFETY PERSONNEL:** List of on-site personnel responsible for monitoring compliance with the Construction Safety and Phasing Plan (CSPP) and SPCD during construction:

Contact Person: \_\_\_\_\_ Phone: \_\_\_\_\_

Contact Person: \_\_\_\_\_ Phone: \_\_\_\_\_

**SUPPLEMENTAL INFORMATION:** The contractor shall list all proposed deviations or modifications to the CSPP for each section listed below. For each alteration the contractor shall provide:

- a. The reason why the alteration is desired.
- b. Provide sufficient narrative description and/or pictorial descriptions of the proposed change so a complete review of the proposal can be made.
- c. If no alterations are to be made to the CSPP, clearly state; "No alterations to the CSPP are proposed."

1. Coordination:

2. Phasing:

3. Areas and Operations Affected by Construction Activity:
4. Protection of NAVAIDs:
5. Contractor Access:
6. Wildlife Management:
7. \*Foreign Object Debris (FOD) Management:
8. \*Hazardous Material (HAZMAT) Management:
9. \*Notification of Construction Activities:
10. Inspection Requirements:
11. Underground Utilities:
12. Penalties:
13. Special Conditions:
14. Runway and Taxiway Visual Aids:
15. Marking and Signs for Access Routes:
16. Hazard Marking and Lighting:
17. Work Zone Lighting for Nighttime Construction (If Applicable)
18. Protection of Runway and Taxiway Safety Areas:
19. Other Limitations on Construction:

\*These items are required to be outlined by the contractor within the SPCD. See the applicable section of the CSPP for detailed instructions.

**FREQUENCY OF INSPECTIONS:** The contractor shall describe the frequency of inspections to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards. Inspections shall ensure that all proper safety devices, signs, demarcations etc. are in place and in proper working order in accordance with the approved CSPP & SPCD. A Construction Project Daily Safety Inspection Checklist is attached to aid in making a thorough inspection.

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**CONTRACTOR MOVEMENTS:** Provide a description of contractor’s plan to restrict movement of construction vehicles and personnel to permitted construction areas by flagging, barricading, erecting temporary fencing, or providing escorts, as appropriate and as specified in the CSPP.

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**AOA PROTECTION:** Provide a description of contractor’s plan to ensure that no contractor employees, employees of subcontractors or suppliers, or other persons enter any part of the air operations area (AOA) unless authorized.

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**SUPPLEMENTAL AIRSPACE STUDY:** If required, provide a description and schedule for any anticipated supplemental submittal through the FAA’s OE/AAA web portal for the purpose of conducting an aeronautical study of contractor equipment that will exceed 15’ in height or stockpiles and haul routes that will differ from those shown in the plans.

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**EMPLOYEE EDUCATION:** Provide a description of contractor’s plan to ensure that construction personnel are familiar with the safety procedures and regulations on the airport, the CSPP, and the SPCD.

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**SPCD AMENDMENT:** The SPCD shall be amended any time there is a construction practice proposed by the contractor that does not conform to the CSPP and SPCD and may impact the airport's operational safety. This will require a revision to the CSPP and SPCD.

**CERTIFICATION**

We have read and understand the operational safety requirements of the CSPP and will abide by all provisions as written and with any additions or amendments as noted in the supplemental information. We will not deviate from the plan unless otherwise approved in writing by the airport operator.

We certify that at least one employee (listed in the "Safety Personnel" section above) familiar with the compliance of the safety plan procedures and the regulations of the airport will be on-site whenever active construction is in progress:

\_\_\_\_\_  
(CONTRACTOR)

BY: \_\_\_\_\_  
(AUTHORIZED SIGNATURE)

\_\_\_\_\_  
(TITLE)

DATE: \_\_\_\_\_

This Checklist is to Provide Guidance to the Contractor for Safety Inspections. All Items Shown will Not be Required for Every Project. It is Only for the Contractor's Use and is Not to be Submitted to the Engineer or Owner.

### Construction Project Daily Safety Inspection Checklist

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the airport operator or contractor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriate for each project.

#### Potentially Hazardous Conditions

Item	Action Required	or	None
Excavation adjacent to runways, taxiways, and aprons improperly backfilled.			<input type="checkbox"/>
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.			<input type="checkbox"/>
Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends.			<input type="checkbox"/>
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.			<input type="checkbox"/>
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.			<input type="checkbox"/>
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.			<input type="checkbox"/>
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.			<input type="checkbox"/>
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.			<input type="checkbox"/>

Item	Action Required	or	None
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.			<input type="checkbox"/>
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.			<input type="checkbox"/>
Wildlife attractants — such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water — on or near airports.			<input type="checkbox"/>
Obliterated or faded temporary markings on active operational areas.			<input type="checkbox"/>
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.			<input type="checkbox"/>
Failures to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.			<input type="checkbox"/>
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.			<input type="checkbox"/>
Restrictions on ARFF access from fire stations to the runway / taxiway system or airport buildings.			<input type="checkbox"/>
Lack of radio communications with construction vehicles in airport movement areas.			<input type="checkbox"/>
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.			<input type="checkbox"/>
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.			<input type="checkbox"/>
Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.			<input type="checkbox"/>

Item	Action Required	or	None
Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).			<input type="checkbox"/>
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.			<input type="checkbox"/>
Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.			<input type="checkbox"/>
Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.			<input type="checkbox"/>
Site burning, which can cause possible obscuration.			<input type="checkbox"/>
Construction work taking place outside of designated work areas and out of phase.			<input type="checkbox"/>

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## ITEM KSA-209 CONCRETE RIPRAP

### DESCRIPTION

**209-1.1** This item shall govern the furnishing and placing of Concrete Riprap in accordance with the plans and these specifications.

### EQUIPMENT AND MATERIALS

**209-2.1 CONCRETE.** Concrete shall be per Item P-610 of these specifications.

**209-2.2 REINFORCEMENT.** Reinforcing steel shall be per Item P-610 of these specifications.

### CONSTRUCTION METHODS

**209-3.1 PREPARATION FOR RIPRAP PLACEMENT.** Dress slopes and protected areas to the line and grade shown on the plans before the placement of riprap. All grading work shall be per Item P-152 of these specifications.

**209-3.2 CONCRETE RIP RAP.** Reinforce concrete riprap with 6 × 6 – W2.9 × W2.9 welded wire fabric or with No. 3 or No. 4 reinforcing bars spaced at a maximum of 18 in. in each direction unless otherwise shown on the plans. Alternative styles of welded wire fabric that provide at least 0.058 sq. in. of steel per foot in both directions may be used if approved. A combination of welded wire fabric and reinforcing bars may be provided when both are permitted. Provide a minimum 6-in. lap at all splices. Provide horizontal cover of at least 1 in. and no more than 3 in. at the edge of the riprap. Place the first parallel bar no more than 6 in. from the edge of concrete. Use approved supports to hold the reinforcement approximately equidistant from the top and bottom surface of the slab. Adjust reinforcement during concrete placement to maintain correct position.

Concrete shall be placed and cured per Item P-610 of these specifications.

### METHOD OF MEASUREMENT

**209-4.1** This item will be measured by the square yard of riprap placed at the thickness indicated on the plans, complete in place.

### BASIS OF PAYMENT

**209-5.1** Payment shall be made at the contract unit price per square yard for concrete riprap. 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, including excavation required to install the riprap.

Payment will be made under:

Item 209-4.1                      Concrete Riprap - per square yard

**END OF ITEM 209**

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# **GEO TECHNICAL REPORT**

**GEOTECHNICAL INVESTIGATION  
TAXIWAY RECONSTRUCTION / WIDENING  
AND APRON CONSTRUCTION  
MESQUITE METRO AIRPORT  
CITY OF MESQUITE, TEXAS  
TxDOT CSJ NO. 2518MSQTE  
KSA PROJECT NO. 104082  
AGG REPORT NO. LE25-022**

**TO  
KSA ENGINEERS, INC.  
McKINNEY, TEXAS**

**BY  
ALLIANCE GEOTECHNICAL GROUP, INC.  
LONGVIEW, TEXAS**

**JANUARY 27, 2026**



GEOTECHNICAL ENGINEERING  
ENVIRONMENTAL CONSULTING  
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

January 27, 2026

Mr. Chad E. Pennel, P.E.  
Senior Project Manager  
**KSA Engineers, Inc.**  
8866 Synergy Drive  
McKinney, Texas 75070

**Re: Geotechnical Investigation  
Taxiway Reconstruction / Widening  
And Apron Construction  
Mesquite Metro Airport  
City of Mesquite, Texas  
TxDOT CSJ NO. 2518MSQTE  
KSA Project No. 104082  
AGG Report No. LE25-022**

Dear Mr. Pennel:

Submitted herein is our geotechnical report for the project referenced above. This study was performed in general accordance with KSA Task Order No. 104082 GEO, dated November 21, 2025. This report describes the results of our field and laboratory investigations together with recommendations for the design and construction of the planned project.

For your construction materials testing and related quality assurance requirements, it is recommended that this work be performed by Alliance Geotechnical Group, Inc. in order to maintain continuity of inspection and testing services for the project under the direction of the geotechnical project engineer.

We appreciate the opportunity to assist you on this project phase. Please call should you have any questions or when we can be of further assistance.

Sincerely,

**ALLIANCE GEOTECHNICAL GROUP, INC.**

Cameron W. Oswald, E.I.T.  
Staff Engineer



TBPE Firm Registration  
Number 1970

01/27/2026

Terry W. Oswald, P.E.  
Vice President

Electronic Copy (PDF) Submitted Via E-Mail



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## APPENDIX

### PAVEMENT CORE REPORTS

**GEOTECHNICAL INVESTIGATION  
TAXIWAY RECONSTRUCTION / WIDENING  
AND APRON CONSTRUCTION  
MESQUITE METRO AIRPORT  
CITY OF MESQUITE, TEXAS  
TXDOT CSJ NO. 2518MSQTE  
KSA PROJECT NO. 104082**

## **1. PROJECT DESCRIPTION**

The proposed project includes the reconstruction and widening of the northernmost taxiway that connects the parallel taxiway to the hangar access taxilanes, as well as construction of a new apron along the north side of the reconstructed taxiway, at the Mesquite Metro Airport in the City of Mesquite, Texas. It is understood that the new approximately 475-foot long taxiway will be widened along the northern edge of the existing paving to provide an approximately 35-foot wide taxiway. In addition, a new approximately 200-foot by 300-foot apron is planned along the north side of the proposed reconstructed taxiway. Site grading requirements were not completed at the time of this report. However, based on visual observations of the existing topography, it is assumed that relatively minor site grading (cuts and fills of less than about one (1) to three (3) feet) will generally be required to achieve finished grade for construction of the proposed improvements. Isolated areas may require additional site grading to facilitate surface water drainage improvements and new construction. A general layout of the site is shown on the Plan of Borings, Figure 1.

## **2. PURPOSE AND SCOPE**

This investigation was designed to evaluate subsurface conditions at the project site and to develop engineering soil design parameters and recommendations to be used to guide design and construction of the proposed improvements. Our scope of services included:

1. performing pavement cores and thickness measurements within the limits of three (3) sample test locations for evaluation of pavement components and thicknesses;
2. obtaining samples of the subsurface soil formations and making groundwater observations within the limits of seven (7) exploratory borings for evaluation of general soil and groundwater conditions;
3. obtaining representative samples of the anticipated subgrade soils for laboratory Proctor compaction and California Bearing Ratio (CBR) tests for evaluation of load bearing characteristics of the existing subgrade soils;
4. performing laboratory soil tests for soil classification and swell characteristics of the subsurface soil strata;
5. performing laboratory Proctor compaction and California Bearing Ratio (CBR) tests for evaluation of the design CBR values;
6. providing recommended pavement subgrade design parameters for aircraft pavement analyses and design studies to be performed by others;
7. providing recommendations for pavement subgrade preparation, including recommended dosage rates of stabilization additives and guideline specifications for subgrade stabilization;

8. providing recommendations for compaction of earthwork including recommendations for suitable fill materials, placement, and compaction; and
9. discussion of potential construction problems.

### **3. FIELD INVESTIGATION**

Subsurface conditions were evaluated by a total of seven (7) sample test borings drilled on December 5, 2025 within the limits of the proposed improvements. Boring locations were selected by and located in the field by representatives of KSA Engineers, Inc. The approximate boring locations are shown on the Plan of Borings, Figure 1.

The Portland cement concrete (PCC) pavement sections, encountered at Borings B-1 through B-3, were cored using a diamond tipped core barrel. The underlying treated subgrade soils, where present, were penetrated for thickness measurements using standard truck-mounted drilling equipment. The borings were drilled and sampled to depths ranging from about 10 to 15 feet below existing grade to evaluate subsurface conditions within the limits of the proposed improvements. Specifically, with the exception of Boring B-5, the borings were drilled and sampled to depths of about 10 feet below existing grade, while Boring B-5, located near the middle of the proposed apron, where past fill had been placed, was drilled and sampled to a depth of about 15 feet below existing grade, in order to extend at least 10 feet below finished grade. Sample depth, soil description and classification (based on the Unified Soil Classification System) are shown on the Logs of Borings, Figures 2 through 8. A key to the descriptive terms and symbols used on the logs is presented on Figure 9. The locations indicated on the boring logs were determined in the field by Alliance Geotechnical Group, Inc. (AGG), using our Trimble Geo 7X handheld GPS unit. The surface elevations indicated on the boring logs were provided by the client, based on the locations determined in the field by AGG.

The components of the existing pavement sections, encountered at Borings B-1 through B-3, were carefully measured during field operations. The results of all field measurements are included on the respective boring logs, Figures 2 through 4, and are summarized on Figure 10. In addition, detailed descriptions and observations of the pavement sections, as well as photographs of the respective pavement cores, are included in the Appendix of this report. The borings were advanced using a truck-mounted drilling rig utilizing continuous flight augers. The subsurface soils were sampled using Shelby tube samplers in accordance with ASTM D1587 and/or a split-barrel sampler in conjunction with the Standard penetration test (SPT). The Standard penetration test (SPT) uses a 2-inch diameter split-barrel sampler driven with a 140-pound hammer, free-falling from a height of 30 inches, in accordance with ASTM D1586. The boreholes were logged in the field by an Alliance Geotechnical Group, Inc. geotechnical engineer, including visual examination of all test samples, classification, and packaging for transport to the laboratory for further identification and classification. Borings were drilled dry, without the aid of drilling fluids, to allow groundwater observations while drilling. Groundwater observations were made during drilling and after completion of the respective borings. These observations are reported on the boring logs. All borings were backfilled with soil cuttings and tamped upon completion of the respective borings. Borings B-1 through B-3, located within the limits of existing site paving, were backfilled with soil cuttings, tamped, the cores placed back into the boreholes to a depth of about 4 to 6 inches below grade, and the surface patched using Rapid Set® High Strength Concrete Patch upon completion of the respective borings.

One (1) representative bulk subgrade sample was obtained for evaluation of Proctor compaction and California Bearing Ratio (CBR) characteristics. The CBR sample, CBR-1, (AGG Sample No. 5034), consisted of the highly plastic (CH) dark gray clay subgrade soils obtained within the upper soil profiles at the boring locations, and combined to produce one (1) representative bulk subgrade sample.

#### **4. LABORATORY INVESTIGATION**

Upon returning to the laboratory, representative specimens were selected for testing. The laboratory testing program was directed toward evaluation of physical and engineering characteristics of the subsurface soils.

Classifications were verified by determination of natural moisture content, liquid and plastic limits, and percent fines passing the No. 200 sieve. The results of these tests are tabulated at the appropriate sample depth on the boring logs.

Strength characteristics of the subsurface clay soils were evaluated in the field by calibrated hand penetrometer strength determinations and/or Standard penetration tests (SPT). The results of all field tests are also shown at the appropriate sample depth on the boring logs.

Laboratory analytical tests were performed on representative samples of the subgrade soils in accordance with TxDOT Test Method Tex-145-E, Part II (Determining Sulfate Content in Soils - Colorimetric Method) to determine concentrations of sulfates for evaluation of the potential for sulfate induced heave. These test results are summarized on Figure 11.

One dimensional swell tests (ASTM D4546, Method B) were performed on representative samples of the overburden clay soils to evaluate potential swell characteristics of the subsurface soils. For this test, the subject sample is placed in a confined ring, then the design load (equal to the overburden pressure) is applied to the sample. The confined ring and sample are then submerged with free water containing surfactant and allowed to swell completely. Once the swell movement stabilizes, the design load is removed, and the sample is retrieved for final moisture content determinations. As a result of the relatively moist condition of the subsurface clay soils at the time of our investigation, selected samples were "air dried" to evaluate swell characteristics at both the in-situ moisture condition (moisture content of the subsurface soils at the time of our investigation) and in "air dried" conditions to simulate dry soil conditions. The results of these tests are summarized on Figures 12 through 14.

The optimum content of stabilization additives were evaluated by a series of liquid and plastic limit tests on lime treated soils. These results are shown on Figures 15 and 16.

A series of California Bearing Ratio (CBR) tests were performed on recompacted subgrade soil samples. The CBR sample, CBR-1 (AGG Sample No. 5034), consisted of the highly plastic (CH) dark gray clay subgrade soils obtained within the upper soil profiles at the boring locations, and combined to produce one (1) representative bulk subgrade sample. One (1) CBR test was performed on the natural (untreated) subgrade soils and one (1) CBR test was performed on lime treated soils. For each CBR test, six (6) CBR values were determined on samples compacted to varying moisture contents and densities. The samples were soaked for 96 hours prior to determination of the CBR value. The results of these tests performed on the natural (untreated) subgrade soils are shown on Figure 17. The results of CBR tests performed on the lime treated subgrade soils are shown on Figure 18.

All field and laboratory tests were performed in accordance with ASTM and/or TxDOT test standards.

## **5. GENERAL SITE AND SUBSURFACE CONDITIONS**

### **5.1 Site Conditions**

The site of the proposed improvements includes the reconstruction and widening of the northernmost taxiway that connects the parallel taxiway to the hangar access taxilanes, as well as the grassy area along the north side of the reconstructed taxiway, at the Mesquite Metro Airport in the City of Mesquite, Texas. It is understood that the new approximately 475-foot long taxiway will be widened along the northern edge of the existing paving to provide an approximately 35-foot wide taxiway. In addition, a new approximately 200-foot by 300-foot apron is planned along the north side of the proposed reconstructed taxiway. The site of the proposed new apron has had fill soils placed over the site over the past years. Specifically, based on visual observations and the results of our field investigation, the interior portion of the proposed apron site appears to have had about one (1) to three (3) feet of fill placed over the site over the past years. It is unknown if these fill soils were placed in compacted lifts. Surface vegetation across the site consists of native grasses and weeds. The topography within the proposed apron is generally rolling with borehole elevations ranging from about El 443.6± (Boring B-7) to about El 445.6± (Boring B-5). The topography along the taxiway gently slopes downwards towards the west with borehole elevations ranging from about El 445.6± (Boring B-1) to about El 443.7± (Boring B-3). The low-lying area in the vicinity of Boring B-3 ponds water. Site grading requirements were not completed at the time of this report. However, based on visual observations of the existing topography, it is assumed that relatively minor site grading (cuts and fills of less than about one (1) to three (3) feet) will generally be required to achieve finished grade for construction of the proposed improvements. Isolated areas may require additional site grading to facilitate surface water drainage improvements and new construction. A general layout of the site is shown on the Plan of Borings, Figure 1.

### **5.2 Subsurface Conditions**

The site of the proposed improvements is located in an area underlain by Quaternary Fluvial terrace deposits, and underlain by the Ozan (lower Taylor marl) Formation, as indicated on the Dallas Sheet of the Geologic Atlas of Texas. Soil formations encountered at the site are shown in detail on the boring logs, Figures 2 through 8. These soils generally consist of moderately to highly plastic (CL and CH) clay and silty clay soils, both fill and natural. Note that depth on the boring logs refers to the depth from the existing grade or ground surface present at the time of this investigation. Boundaries between the various soil types are approximate, and the actual transition may be gradual.

The components of the existing pavement sections, encountered at Borings B-1 through B-3, were carefully measured during field operations. The results of all field measurements are included on the respective boring logs, Figures 2 through 4, and are summarized on Figure 10. In addition, detailed descriptions and observations of the pavement sections, as well as photographs of the respective pavement cores, are included in the Appendix of this report. These results indicate that the existing Portland cement concrete (PCC) pavement encountered at Boring B-1 measured about 14-1/8 inches in thickness, while the pavement sections encountered at Borings B-2 and B-3 ranged from about 6-1/2 to 7-1/4 inches in thickness. Based on visual examination of the subgrade soils immediately below the pavement sections using phenolphthalein indicator, the subgrade soils encountered in Borings B-2 and B-3 appear to have been treated with stabilization additives to depths of

about four (4) inches below existing pavement subgrade. Based on visual examination of the subgrade soils immediately below the pavement section using phenolphthalein indicator, the subgrade soils encountered in Boring B-1 do not appear to have been stabilized (not detectable using phenolphthalein indicator).

Obvious fill soils consisting of moderately to highly plastic (CL and CH) brown and gray silty clay soils containing varying amounts of sand, gravel, calcareous nodules and inclusions, and dark gray clay seams, layers and pockets were encountered within the interior portions of the proposed apron in Borings B-5 and B-6, to depths ranging from about 2 to 3 feet below existing grade at the boring locations, as indicated on the boring logs. As indicated above, these clay fill soils appear to have been placed within the proposed apron area over the past years. As indicated above, it is unknown if these fill soils were placed in compacted lifts. An approximately 3-inch thick dark gray clay layer was noted at a depth of about 2 feet below existing grade in Boring B-5, as indicated on the boring log. These silty clay soils are considered medium stiff in consistency at the time of our investigation, having Standard penetration test (SPT) blow counts ranging from about 4 to 5 blows per foot of penetration. These silty clay soils exhibited liquid limits ranging from about 44 to 69, plasticity indices (PI's) ranging from about 31 to 46, and contained about 60 to 69 percent fines (silt and clay passing the No. 200 sieve). In their present moisture content (having moisture contents at the time of our investigation ranging from about 2 percentage points below to 2 percentage points above (-2% to +2%) their plastic limits), these silty clay soils are generally considered moderately to highly expansive with future increases in moisture.

Possible fill soils consisting of highly plastic (CH) dark gray clay soils containing varying amounts of light gray and yellowish brown clay inclusions, calcareous nodules and inclusions were encountered in the borings to depths ranging from about 2.5 feet below existing grade at Boring B-3 to the 10-foot completion depth of Boring B-2, as indicated on the boring logs. These dark gray clay (possible) fill soils are considered medium stiff to very stiff in consistency at the time of our investigation, having penetrometer readings ranging from about 0.75 to 4.0 tons per square foot (tsf) and Standard penetration test (SPT) blow counts of about 8 blows per foot of penetration. These clay (possible) fill soils exhibited liquid limits ranging from about 71 to 86, plasticity indices (PI's) ranging from about 48 to 60, and contained about 93 to 98 percent fines (silt and clay passing the No. 200 sieve). In their present moisture content (moisture contents at the time of our investigation), having moisture contents ranging from about 2 to 16 percentage points above (+2% to +16%) their respective plastic limits), these clay (possible) fill soils are considered only slightly to moderately expansive with future increases in moisture as shown on Figures 12 through 14. However, in their dry condition, these clay (possible) fill soils are considered highly expansive with future increases in moisture, as shown on Figures 12 through 14.

The dark gray clay (possible) fill soils are generally underlain by highly plastic (CH) light gray clay soils containing varying amounts of calcareous nodules and inclusions, iron stains, and gray clay inclusions. These clay soils were encountered to the 10-foot completion depths at Borings B-1, B-3, B-4, B-6 and B-7, as indicated on the boring logs. Likewise, these clay soils were encountered in Boring B-5 to a depth of about 12 feet below existing grade at the boring location, as indicated on the boring log. These clay soils were not encountered in Boring B-2, as indicated above. These clay soils are considered stiff to very stiff in consistency at the time of our investigation, having penetrometer readings ranging from about 2.0 to 4.0 tons per square foot (tsf) and Standard penetration test (SPT) blow counts ranging from about 9 to 19 blows per foot of penetration. These clay soils exhibited liquid limits ranging from about 69 to 81, plasticity indices (PI's) ranging from about 47 to 57, and contained about 84 to 96 percent

fines (silt and clay passing the No. 200 sieve). In their present moisture content (moisture contents at the time of our investigation), having moisture contents ranging from about 1 to 10 percentage points above (+1% to +10%) their respective plastic limits, these clay soils are generally considered moderately to highly expansive with future increases in moisture.

The highly plastic (CH) light gray clay soils encountered in Boring B-5 are underlain by highly plastic (CH) light gray and yellowish brown silty clay soils containing varying amounts of calcareous nodules and inclusions, iron stains, and gray clay inclusions to the 15-foot completion depth of the boring, as indicated on the boring log. These silty clay soils are considered stiff in consistency at the time of our investigation, having Standard penetration test (SPT) blow counts of about 14 blows per foot of penetration. These silty clay soils exhibited a liquid limit of about 58, a plasticity index (PI) of about 37, and contained about 98 percent fines (silt and clay passing the No. 200 sieve). In their present moisture content (moisture contents at the time of our investigation), having moisture content of about 1 percentage point above (+1%) their respective plastic limits, these silty clay soils are generally considered moderately to highly expansive with future increases in moisture.

### **5.3 Groundwater Conditions**

At the time of this investigation, groundwater seepage was not encountered during the drilling operations. The borings were dry and open to their respective 10-foot and 15-foot completion depths upon completion of the drilling operations, as indicated on the boring logs. It should be recognized that groundwater levels will fluctuate with variations in seasonal precipitation, and surficial runoff. Likewise, discontinuous zones of perched water may exist within near surface fill soils. If construction occurs during or following periods of heavy rainfall, shallow groundwater should be anticipated in the form of seepage within granular soil layers, through the cracks, fissures and fractures within the overburden clay soils, as well as discontinuities within overburden fill soils. Future construction activities may also alter the surface and subsurface drainage characteristics of this site. Therefore, the depth of groundwater should be verified just prior to construction. If there is a noticeable change from the conditions reported herein, Alliance Geotechnical Group, Inc., should be notified immediately to review the effects it may have on the design recommendations. It is not possible to accurately predict the magnitude of subsurface water fluctuation that might occur based upon short-term observations.

Shallow groundwater levels are not desired for optimum pavement performance. Shallow groundwater levels trapped within granular soil layers and/or granular (aggregate) base materials cause strength loss of granular materials and subgrade soils, resulting in premature deterioration of the pavement sections. Due to the presence of moderately to highly plastic (CL and CH) clay and silty clay soils and the potential for trapping surface water within granular (aggregate) base layers, subgrade drainage systems should be considered adjacent to all pavement sections containing granular (aggregate) base materials, if applicable. The purpose of the subsurface drainage system is to intercept any surface water and/or groundwater seepage trapped (perched) within the adjacent granular (aggregate) base layers. Recommendations regarding subgrade drainage improvements are presented in the following section of this report, Section 6.1.5, Pavement Subgrade Drainage.

### **5.4 Evaluation of Sulfate Concentrations**

Analytical testing was performed on representative samples of the subgrade soils to determine their concentrations of sulfates in accordance with TxDOT Test Method Tex-145-E, Part II (Colorimetric Method) for evaluation of the potential for sulfate induced heave.

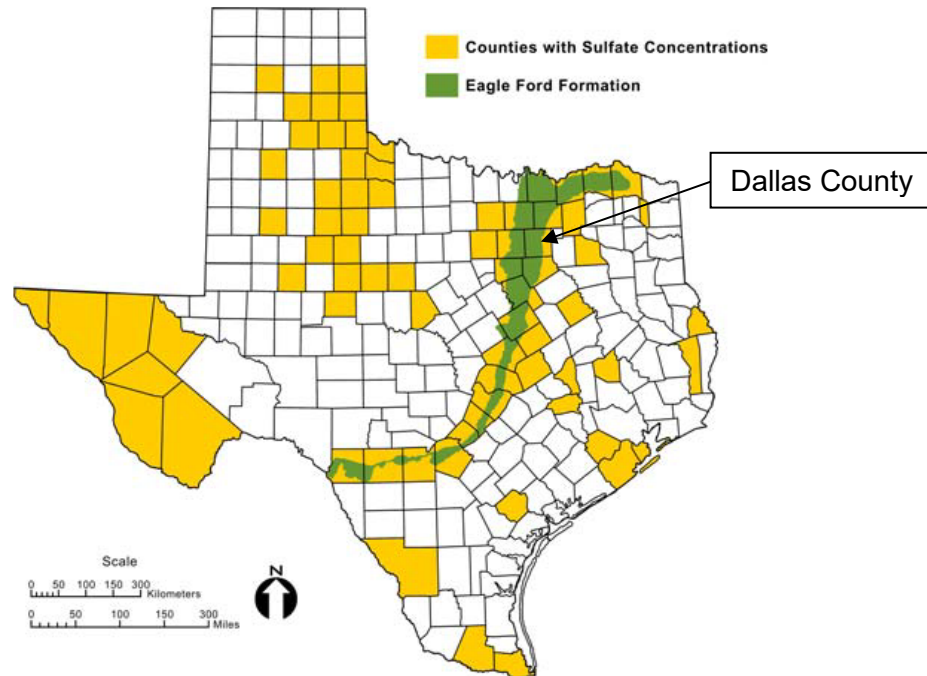
Results of these tests are summarized on Figure 11. Large detectable gypsiferous crystals were not detected during visual examination of the test samples. Likewise, the test results indicated concentrations of sulfates within the selected test samples were less than 100 parts per million (ppm).

In accordance with paragraph 2.4.6.1 of Advisory Circular AC 150/5320-G, Airport Pavement Design and Evaluation, dated 6/7/2021, "Exercise caution when soluble sulfates content is greater than 3000 ppm, and incorporate measures to control expansion potential when greater than 5000 ppm." Likewise, according to the Texas Department of Transportation (TxDOT) Treatment Guidelines for Soils and Bases in Pavement Structures, dated August 2019, research and field experience have shown that soils with sulfate levels of 3,000 ppm or less pose low potential for sulfate heave. Standard construction and mix design practices, as specified in Item 260 and/or Item 275 of the Texas Department of Transportation (TxDOT) Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, 2024 Edition, can be utilized to treat soils exhibiting sulfate concentrations below 3,000 ppm. Sulfate reaction may still occur in these types of soils, but with adequate mixing and moisture, the effects are typically not detrimental. Likewise, research and some cursory field data has shown that soils with sulfate levels greater than 3,000 ppm but less than or equal to 7,000 ppm can be successfully treated with lime. However, modified construction methods must be followed to treat soils exhibiting sulfate concentrations greater than 3,000 ppm but less than or equal to 7,000 ppm in order to ensure the prevention and mitigation of sulfate heave. These modified methods include the laboratory determination of the amount of time and moisture content of the soil-lime mixture (at the optimum lime content) required to reduce the sulfate content to 3,000 ppm. This amount of time and moisture content can then be used in the field as controls for mellowing time and moisture content. For soils with sulfate contents higher than 7,000 ppm, the normal recommendation is to either remove and replace with low sulfate materials and then lime treat or use flexible base materials in lieu of lime treatment. Since high concentrations of sulfates can be very isolated across a site, extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the exposed subgrade soils, and additional analytical testing performed on selected subgrade samples, after the pavement areas have been brought to final subgrade elevation (prior to stabilization operations).

Figure 2 of the Texas Department of Transportation (TxDOT) Guidelines for Treatment of Sulfate-Rich Soils and Bases in Pavement Structures, dated September 2005, identifies counties where measurable sulfate concentrations have been detected. The sulfate-rich soils are typically associated with the Eagle Ford Shale Formation, which overlies portions of the DFW area and extends generally along IH-35 southward. The use of TxDOT's maps (See Figure 2 below) and guidelines have been used by the industry to identify areas known to have problematic sulfate concentrations.

Dallas County, Texas, as well as the surrounding counties to the north, west, and south of Dallas County, are shown to have had measurable sulfate concentrations in excess of 100 parts per million (ppm). It should be noted that concentrations of soluble sulfates in soils are typically very localized and concentrations in other areas of the site could vary significantly. Based on recent studies, subgrade and/or subsurface soils within various counties of Texas which are shown on Figure 2 not to have had any measurable sulfate concentrations in excess of 100 parts per million (ppm), have actually been found to contain significant concentrations of sulfates (in excess of 20,000 ppm). Therefore, as indicated above, since high concentrations of sulfates can be very isolated across a site, extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical

Engineer on the exposed subgrade soils, and additional analytical testing performed on selected subgrade samples, after the pavement areas have been brought to final subgrade elevation (prior to stabilization operations).



**Figure 2:** Texas counties with measurable sulfate concentrations (>100 ppm).

Since concentrations of sulfates within the selected test samples were less than 100 parts per million (ppm), after the pavement areas have been brought to final subgrade elevation (prior to stabilization operations), extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the exposed subgrade soils and additional analytical testing performed on selected subgrade samples to determine their concentrations of sulfates for evaluation of the potential for sulfate induced heave, if applicable. **Due to the isolated nature of soils containing high sulfate contents, as a minimum, analytical testing should be performed on the subgrade soils at a rate of at least one test per 100 linear feet along the alignment or a minimum of one test per 500 square yards of surface area, whichever is greater, if applicable.** Subgrade soils suitable for treatment operations with stabilization additives shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method) in accordance with TxDOT Guidelines.

## 6. ANALYSES AND GEOTECHNICAL RECOMMENDATIONS

The recommendations given in this report were prepared exclusively for KSA Engineers, Inc., the Mesquite Metro Airport, the City of Mesquite, Texas, the Texas Department of Transportation (TxDOT) Aviation Division, and their design consultants. The information supplied herein is applicable for the design of the previously described improvements to be

constructed at the locations indicated at these sites and should not be used for any other purpose.

## **6.1 Pavement Recommendations**

Site paving is planned to consist of Portland cement concrete pavement sections. Site grading requirements were not completed at the time of this report. However, based on visual observations of the existing topography, it is assumed that relatively minor site grading (cuts and fills of less than about one (1) to three (3) feet) will generally be required to achieve finished grade for construction of the proposed improvements. Isolated areas may require additional site grading to facilitate surface water drainage improvements and new construction. Therefore, exposed subgrade soils are anticipated to consist of moderately to highly plastic (CL and CH) clay and silty clay soils, both fill and natural. It is recommended that the subgrade soils in all pavement areas be treated with stabilization additives to provide a firm, stable subgrade soil conditions for new pavement construction, minimize the potential for piping beneath the pavement sections after construction, and increase the long term performance of the pavement sections.

**After the pavement areas have been brought to final subgrade elevation (prior to treatment operations), extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the exposed subgrade soils and additional analytical testing performed on selected subgrade samples to determine their concentrations of sulfates for evaluation of the potential for sulfate induced heave. Due to the isolated nature of soils containing high sulfate contents, as a minimum, analytical testing should be performed on the subgrade soils at a rate of at least one test per 100 linear feet along the alignment or a minimum of one test per 500 square yards of surface area, whichever is greater. Subgrade soils suitable for treatment operations shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method).**

### **6.1.1 Pavement Subgrade Design Parameters**

Site grading requirements were not completed at the time of this report. However, based on visual observations of the existing topography, it is assumed that relatively minor site grading (cuts and fills of less than about one (1) to three (3) feet) will generally be required to achieve finished grade for construction of the proposed improvements. Isolated areas may require additional site grading to facilitate surface water drainage improvements and new construction.

California Bearing Ratio (CBR) test results performed on the highly plastic (CH) dark gray clay subgrade soils shown on Figure No. 17 indicate a CBR value ranging from about 2 or 3 to about 3 or 4 at about 95% standard Proctor density compaction and moisture contents ranging from about 23.3 to 34.1 percent (about 4.5 percentage points below (-4.5%) to about 6.3 percentage points above (+6.3%) the optimum moisture value). Likewise, at moisture contents within 3 percentage points of the optimum moisture value ( $\pm 3\%$ ) and compaction levels (percent densities) ranging from about 97.6% to 98.5% of the maximum dry density value determined by the standard Proctor test (ASTM D698), these clay subgrade soils (CBR-1) indicated a CBR value ranging from about 2 or 3 to about 4. The clay subgrade soils encountered in the borings (having physical properties comparable to CBR-1) revealed moisture contents ranging from about 32 to 39 percent. Based on the results of the CBR tests (CBR-1), these subgrade soils should have a CBR value ranging from less than 3 to about 4

at these moisture contents. It should be noted that these CBR values represent “soaked” subgrade conditions and are not always indicative of actual field conditions. Based on the results of the CBR tests, it recommended that a CBR value of about 2 be used for the design of these pavement sections. It is our opinion that a CBR value of 2 is relatively conservative and should be representative of actual field conditions.

It should be noted that FAA pavement design criteria indicate that a CBR value of 20 be used for subbase materials (FAA Item P-154). Materials meeting this specification consist of hard, durable particles or fragments of granular aggregates. California Bearing Ratio (CBR) test results performed on the lime treated (8% lime) dark gray clay soils shown on Figure 18 indicate a CBR value of about 14 or 15 at about 95% standard Proctor density compaction and moisture contents ranging from about 28.3 to 39.6 percent (about 6.3 percentage points below (-6.3%) to about 5.0 percentage points above (+5.0%) the optimum moisture value). In addition, at moisture contents within 3 percentage points of the optimum moisture value ( $\pm 3\%$ ) and compaction levels (percent densities) ranging from about 98.0% to 98.6% of the maximum dry density value determined by the standard Proctor test (ASTM D698), these lime treated clay soils indicate a CBR value ranging from about 21 to about 22 or 23. It should be noted that these CBR values represent “soaked” subgrade conditions and are not always indicative of actual field conditions. Since moisture contents of treated subgrade soils tend to increase over time, resulting in subgrade softening, it is recommended that a CBR value of about 8 (for treated subgrade soils) be used for the analyses and design of these pavement sections. It is our opinion that a CBR value of 8 is relatively conservative and should be representative of actual field conditions.

The recommended CBR values indicated below for new pavement design are based on the assumption that a firm subgrade (verified by proofrolling), having adequate moisture content and density, is present at the time of construction, and that surface and, if appropriate, subsurface drainage improvements are provided as indicated above, and the lime treatment of the subgrade soils is performed as outlined below.

Pavement analyses and design studies require the use of soil properties or the results of specific tests to determine appropriate design parameters. Based on the results of the field and laboratory investigation on soil plasticity properties, the following parameters may be used for the pavement analyses and design studies:

Subgrade Soil:	Clays and Silty Clays, Both Fill and Natural
Classification by USCS:	CL and CH
California Bearing Ratio (CBR):	
Subgrade:	2 (E = 3,000 psi)
Subbase (Lime Treated Subgrade):	8 (E = 12,000 psi)

### **6.1.2 Differential Upward Pavement Movements**

It is important to consider the potential for differential upward pavement movement due to post-construction soil swelling in areas where new pavement construction is performed adjacent to existing pavement sections. Optimum moisture levels are usually present beneath existing pavement sections since the existing pavement section serves as a moisture barrier in preventing moisture losses in the underlying clays. However, where new construction is performed over unpaved and unprotected highly plastic clay soils exposed to moisture losses

through evaporation, the clay soils in these unprotected areas usually have a higher swell potential (higher PVR) unless construction occurs during and/or after the rainy season when the surficial clays are moist. However, if construction occurs during or after prolonged periods of hot and dry weather conditions, the surficial clays will dry rapidly, resulting in a higher swell potential. Since widening of the taxiway will be required along the north side of the existing taxiway, the potential exists for future differential upward ground movements (in a transverse direction) associated with swelling of the surficial clay soils (presently unprotected).

As indicated above, optimum moisture levels are usually present beneath existing pavement sections which are to be removed and reconstructed since the existing pavement serves as a moisture barrier in preventing moisture losses in the underlying clay soils. At the time of our investigation (borings drilled December 5, 2025, after above normal rainfall), the subsurface clay soils are relatively moist as discussed above. In general, differential PVR is estimated to be less one (1) inch at the present time, as a result of the relatively moist subsurface soil conditions and the existing pavement sections protecting the subgrade soils from excessive moisture losses. In some isolated areas of the site, differential PVR is estimated to be on the order of about one (1) to two (2) inches at the present time. However, if construction occurs during or after prolonged periods of hot and dry weather and the surficial clays are allowed to become dry and desiccated, differential upward pavement movements in excess of about nine (9) inches could occur between the existing pavement section and the proposed new construction, due to post-construction swelling of the active CH clay soils beneath new (presently unprotected) construction, as shown on Figures 12 through 14.

On previous paving projects where new pavement sections are constructed over expansive clay soils, the standard of care used was to reduce the differential PVR to less than about one (1) inch by means of excavation/mechanical reworking or water injection stabilization. Differential movements of greater magnitude can generally be tolerated if thicker concrete pavement sections are provided and/or provided with reinforcement to resist differential post-construction upward ground movements due to soil swelling.

Due to the relatively small paving area abutting existing pavements, water pressure injection to pre-swell the clay soils at this site would likely be cost prohibitive. Therefore, it appears that excavation/mechanical reworking of the on-site clays would be required to reduce the potential for post-construction upward pavement movements.

Due to the presence of moderately to highly plastic (CL and CH) clay and silty clay soils anticipated in the upper soil profile at this site, excavation/mechanical reworking of the on-site clays (in areas adjacent to existing paving) in moisture and density-controlled lifts may be required to minimize potential upward pavement movements. If construction occurs in late winter or spring (after the rainy season) and the clay subgrade soils are still moist, it is possible that excavation/mechanical reworking of the clay subgrade soils may not be required. However, if construction occurs in late summer or fall (after prolonged periods of hot and dry weather conditions), the near surface clay soils will become desiccated due to the hot and dry weather conditions, and excavation/mechanical reworking of the clay subgrade soils should be considered to minimize the potential for differential upward pavement movements due to post-construction soil swelling. Excavation/mechanical reworking of the on-site clays (in areas presently unpaved) in moisture-controlled lifts should be considered to minimum depths of about 36 inches (3 feet) below the bottom of the treated subgrade as outlined in the following section in order to minimize potential upward pavement movements. The potential for differential upward pavement movements due to post-construction soil swelling is of particular concern adjacent to and/or within about 100 feet of existing pavement sections. The

depth (below the bottom of the treated subgrade soils) of excavation/mechanical reworking of the clay subgrade soils may be tapered from a minimum depth of 36 inches below the bottom of the treated subgrade soils within 50 feet of existing pavement sections to about 18 inches below the bottom of the treated subgrade soils from about 50 to 100 feet of existing pavement sections. A contingency for this additional subgrade preparation and stabilization, if required, should be included as a possible line item in the construction documents. During construction, the subgrade soils shall be inspected by an experienced Alliance Geotechnical Group, Inc. geotechnical engineer to evaluate the moisture condition of the clay subgrade soils and/or field delineate areas requiring excavation/mechanical reworking at the time of construction.

The above recommendations regarding excavation/mechanical reworking of the clay soils within the widened areas assumes that reconstruction of the taxiway is performed in such a manner that the clay subgrade soils (presently protected due to existing paving) are not left unprotected for a prolonged period of time (after the pavement has been removed) and the clay soils are not allowed to become excessively dry prior to reconstruction. If the clay subgrade soils within the limits of existing paving are allowed to become dry and desiccated, excavation/mechanical reworking of the on-site clays in moisture-controlled lifts should also be considered to minimize upward pavement movements in a longitudinal direction. If the clay subgrade soils within the limits of existing paving are allowed to become excessively dry during construction, excavation/mechanical reworking of the on-site clays in moisture-controlled lifts should be performed to a minimum depth of 12 inches below the treated subgrade as outlined in the following section.

### **6.1.3 Pavement Subgrade Preparation**

Site grading requirements were not completed at the time of this report. However, based on visual observations of the existing topography, it is assumed that relatively minor site grading (cuts and fills of less than about one (1) to three (3) feet) will generally be required to achieve finished grade for construction of the proposed improvements. Isolated areas may require additional site grading to facilitate surface water drainage improvements and new construction. Therefore, exposed subgrade soils are anticipated to consist of moderately to highly plastic (CL and CH) clay and silty clay soils, both fill and natural. It is recommended that the subgrade soils in all pavement areas be treated with stabilization additives to provide a firm, stable subgrade soil conditions for new pavement construction, minimize the potential for piping beneath the pavement sections after construction, and increase the long term performance of the pavement sections.

**Due to the presence of moderately to highly plastic (CL and CH) clay and silty clay soils anticipated in the upper soil profile at this site, excavation/mechanical reworking of the on-site clays in moisture and density controlled lifts in areas adjacent to existing paving should be considered to minimize potential upward pavement movements, as discussed above in Section 6.1.2, Differential Upward Pavement Movements. Excavation/mechanical reworking of the on-site clays in moisture controlled lifts, if required, should be performed as outlined below.**

**After the pavement areas have been brought to final subgrade elevation (prior to treatment operations), extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the exposed subgrade soils and additional analytical testing performed on selected subgrade samples to determine their concentrations of sulfates for evaluation of the potential for sulfate induced heave. Due to the isolated nature of soils containing high**

**sulfate contents, as a minimum, analytical testing should be performed on the subgrade soils at a rate of at least one test per 100 linear feet along the alignment or a minimum of one test per 500 square yards of surface area, whichever is greater. Subgrade soils suitable for treatment operations shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method).**

Surface drainage is critical to the performance of this pavement. Water should be allowed to exit the pavement surface quickly. The maximum slope of the finished grades allowed by FAA should be used for this project.

It cannot be overemphasized that it is imperative that a firm subgrade condition be provided (verified by proofrolling) and maintained during construction. Recommended earthwork construction and pavement subgrade preparation procedures are as follows:

1. Remove and waste the existing Portland cement concrete pavement sections, subbase materials, any surface vegetation, organic topsoil, loose organics, debris, and any undesirable materials from the construction area. Usable topsoil should be stockpiled for later use in landscaping. Topsoil is defined as the surface soil layer containing organic matter and minor plant roots, free of debris or other deleterious materials.

The on-site, obvious fill soils, encountered within the interior portion of the proposed apron (in Borings B-5 and B-6) should be removed and stockpiled separately. These silty clay fill soils may be suitable for fill soils, if placed in moisture and density controlled lifts.

As part of the site preparation, good surface drainage should be initiated at the beginning of construction and maintained thereafter to prevent ponding of water in the pavement and fill areas. Surface water should be pumped immediately from the construction area after each rain and a firm subgrade maintained.

2. As indicated above, due to the presence of moderately to highly plastic (CL and CH) clay and silty clay soils anticipated in the upper soil profile at this site, excavation/mechanical reworking of the on-site clays in moisture and density controlled lifts in areas adjacent to existing paving should be considered to minimize potential upward pavement movements, as discussed above in Section 6.1.2, Differential Upward Pavement Movements.

It is recommended that shallow test pit excavations be performed by the contractor at the time of construction within the areas presently unpaved (i.e., at the time when subgrade preparation procedures are being performed in preparation for the pavement subgrade treatment operations). In cut areas, the soil shall be cut to grade prior to excavation of the shallow test pits. In place (nuclear) density tests (ASTM D6938) should then be performed on the subgrade soils at each 6-inch depth increment (and six (6) inch (probe depth) tests) to depths of at least 30 inches below the bottom of the treated subgrade at each test pit excavation (i.e., six (6) inch (probe depth) tests at a depth corresponding to the bottom of the treated subgrade; at a depth of about six (6) inches below the bottom of the treated subgrade; at a depth of about twelve (12) inches below the bottom of the treated subgrade; etc., to a depth of about thirty (30) inches below the bottom of the treated subgrade). If the moisture content of the clay subgrade soils at the time of construction meets project specifications, based on the plasticity index (PI) of the respective subgrade soils, excavation/mechanical reworking of the subgrade soils will not be required. During construction, the subgrade soils shall be inspected by an experienced Alliance

Geotechnical Group, Inc. geotechnical engineer to field delineate areas requiring excavation/mechanical reworking at the time of construction.

If excavation/mechanical reworking of the on-site clay fill soils within presently unpaved areas in moisture and density controlled lifts is required to minimize potential upward pavement movements, the upper 38 inches of subgrade (to a depth of about 30 inches below the bottom of the 8-inch thick lime treated subgrade) shall be excavated and stockpiled on-site. Where possible, excavation shall extend a minimum of five (5) feet beyond the limits of the pavement section. The underlying clay fill subgrade soils at the base of the excavation shall then be scarified to a minimum depth of six (6) inches, the moisture content adjusted and the subgrade recompacted in accordance with Item 4, below. Subsequent fill placement should be performed in maximum six (6) inch lifts in accordance with the moisture content and density requirements indicated below, Item 4. The first lift of fill shall be placed within 48 hours of satisfactory compaction of the underlying subgrade soils. Likewise, subsequent lifts of fill shall be placed and compacted within 48 hours of satisfactory compaction of the previous lift of fill.

The potential for differential upward pavement movements due to post-construction soil swelling is of particular concern adjacent to and/or within about 100 feet of existing pavement sections. The depth (below the bottom of the lime treated subgrade soils) of excavation/mechanical reworking of the clay subgrade soils may be tapered from a minimum depth of 36 inches below the bottom of the lime treated subgrade soils within 50 feet of existing pavement sections to about 18 inches below the bottom of the lime treated subgrade soils from about 50 to 100 feet of existing pavement sections.

**Note:** A pulverizing rotary mixer (commonly used during subgrade stabilization operations) should be considered to achieve a relatively uniform moisture content within each lift of clay fill, as specified above, prior to compaction of each lift.

3. All pavement and fill areas shall be proofrolled prior to fill placement and/or new pavement construction to detect any areas of weakness. In cut areas, the soil shall be cut to grade prior to proofrolling. Proofrolling shall be performed in accordance with Item P-152 of the latest change to the Federal Aviation Administration (FAA) Standards for Specifying Construction of Airports, AC 150/5370-10H, dated December 21, 2018, Paragraph 152-2.9, Proofrolling or performed in accordance with Texas Department of Transportation (TxDOT) Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, 2024 Edition, Item 216, Proofrolling.

As a minimum, the subgrade soils should be proofrolled using a heavy (20 tons or greater total weight) pneumatic tired roller making several passes over the areas to detect any areas of weakness. The proofrolling operations should be observed by an experienced Alliance Geotechnical Group, Inc. engineer or geotechnician to verify that firm non-yielding subgrade soils are present. Any soft or compressible areas detected during proofrolling shall be undercut until firm soil is exposed. Low areas resulting from undercutting shall be filled in compacted lifts in accordance with Item 4, below. It cannot be overemphasized that the proofrolling is imperative to assure that a firm subgrade is present beneath the new pavement section. It is also imperative that a firm subgrade be provided and maintained during construction.

4. In fill areas, scarify the exposed subgrade (after proofrolling) to a minimum depth of eight (8) inches, adjust the moisture content and recompact to within the limits indicated below.

Low plasticity sandy soils having a plasticity index (PI) of 15 or less shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content within three percentage points ( $\pm 3\%$ ) of the optimum moisture value. Sandy clay and/or calcareous clay soils having a plasticity index (PI) between 16 and 25 shall be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one percentage point below to five percentage points above the optimum moisture value (-1% to +5%). Moderately to highly plastic clay soils having a plasticity index (PI) between 26 and 35 shall be compacted to between 95% and 100% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one to six percentage points above the optimum moisture value (+1% to +6%). Highly plastic clay soils having a plasticity index (PI) of 36 or more shall be compacted to between 93% and 98% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from three to eight percentage points above the optimum moisture value (+3% to +8%). The recommended moisture content at the time of compaction and the density limits are listed below based on the plasticity index (PI) of the respective subgrade and/or fill soils. **Overcompaction of highly plastic (CH) clay soils having a plasticity index (PI) of 26 or greater, shall not be allowed.**

<u>Plasticity Index (PI)</u>	<u>Moisture Content Range at Time of Compaction (%)</u>	<u>Percent Maximum Dry Density (%) *</u>
$\leq 15$	<u>+3%</u>	95% +
16 to 25	-1% to +5%	95% +
26 to 35	+1% to +6%	95% to 100%
$\geq 36$	+3% to +8%	93% to 98%

\* Percent of the maximum density defined by ASTM D-698 (standard Proctor).

The last eight (8) inch thick lift of moisture conditioned clay (below the lime treated subgrade) should be compacted to a minimum of 95% of the maximum density defined by ASTM D698 (standard Proctor), at a moisture content ranging from one percentage point below to five percentage points above the optimum moisture value (-1% to +5%). This includes clay soils having a plasticity index (PI) of 26 or more, if present.

- Where fill is required to achieve the desired grades, such material may consist of on-site soils, or their approved off site equal. All off-site fill soils shall be free of organic matter, or rock fragments larger than two (2) inches in any dimension, and possessing a plastic index (PI) between 10 and 50, with a liquid limit of 75 or less. Use of rock fragments and/or soil clods greater than two (2) inches in any dimension should be prohibited, since attaining a uniform moisture and density without voids would be difficult. All fill shall be placed in maximum eight (8) inch lifts in accordance with the moisture content and density requirements indicated above, Item 4. The first lift of fill shall be placed within 48 hours of satisfactory compaction of the underlying subgrade soils. Likewise, subsequent lifts of fill shall be placed and compacted within 48 hours of satisfactory compaction of the previous lift of fill.

Analytical testing shall be performed on all fill soils required for grading operations prior to placement operations to determine their concentrations of sulfates for evaluation of the

potential for sulfate induced heave. Acceptable on-site fill soils shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method). Acceptable off-site fill soils shall have sulfate concentrations of 1,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method).

All fill shall be placed in properly benched horizontal lifts not exceeding eight (8) inches in thickness and compacted in accordance with the moisture content and density requirements indicated above in Item 4. If shallow fills are required along sideslopes, the sideslopes shall be properly benched prior to fill placement to allow placement of fill soils in horizontal compacted lifts. Horizontal benches must be sufficiently wide to accommodate both the construction equipment and to allow for the related placement and compaction operations. Placement of fill soils in sloped lifts shall not be allowed, regardless of fill depths. Where cuts are required along existing sideslopes, the slopes should be compacted after excavation to final grade to tighten the surficial soils loosened during excavation operations.

Each layer (lift) shall be leveled with approved equipment. After spreading, each layer shall be thoroughly manipulated by plowing, discing, or other approved methods for the full depth of the lift being placed to ensure relatively uniform moisture distribution throughout the lift for proper compaction. The moisture content at the time of compaction shall be within the ranges recommended above in Item 4. If the material is too dry, it shall be moistened by watering before and during manipulation, to properly moisture condition the material for compaction. If the material is too wet, the compaction operation shall be delayed until the moisture content has been reduced to within the satisfactory range for compaction. Because of time of completion limitations, thoroughly processing of the on-site clay soils will be required during manipulation if the moisture content is below the specified range at the time of placement. Each lift shall be processed until the soil mixture is free of large clods to allow uniform moisture distribution and uniform compaction within the entire fill lift. The amount of processing and reworking required to achieve uniform moisture conditions can be reduced by pre-wetting the soils prior to placement on-site.

**Note:** A pulverizing rotary mixer (commonly used during subgrade treatment operations) should be considered to achieve a relatively uniform moisture content within each lift of clay fill, as specified above, prior to compaction of each lift.

6. **After the pavement areas have been brought to final subgrade elevation (prior to treatment operations), extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the exposed subgrade soils and additional analytical testing performed on selected subgrade samples to determine their concentrations of sulfates for evaluation of the potential for sulfate induced heave. Due to the isolated nature of soils containing high sulfate contents, as a minimum, analytical testing should be performed on the subgrade soils at a rate of at least one test per 100 linear feet along the alignment or a minimum of one test per 500 square yards of surface area, whichever is greater. Subgrade soils suitable for treatment operations shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method).**
7. The upper eight (8) inches of the subgrade in all pavement areas should be treated in accordance with the applicable provisions of Item P-155 of the latest change to the Federal

Aviation Administration (FAA) Standards for Specifying Construction of Airports, AC 150/5370-10H, dated December 21, 2018 or Item 260 of the Texas Department of Transportation (TxDOT) Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, 2024 Edition, as outlined below in Section 6.1.4, Pavement Subgrade Treatment, and associated subsection. Strength testing of the lime treated subgrade soils, as outlined in TxDOT Item 260, may be omitted.

A minimum of eight percent (8%) hydrated lime (minimum 54 pounds per square yard for an eight (8) inch treatment depth) should be used to treat the clay subgrade soils, as outlined below in Section 6.1.4, Pavement Subgrade Treatment, and associated subsection.

8. Verify compaction of pavement fill and/or treated subgrade soils by in-place (nuclear) density tests (ASTM D6938) at the rate of at least one test per 1,000 square yards of surface area for each lift or a minimum of three (3) tests per construction area, whichever is greater, for each lift of material placed

At each in-place density test location performed on the treated subgrade soils, a representative sample of the treated subgrade soils shall be obtained and laboratory oven dried moisture content tests (ASTM D2216) performed to determine the moisture content of the treated subgrade soils. The dry density values used for evaluating compaction levels (percent density) shall be calculated based on the wet density values determined in the field in accordance with ASTM D6938 (nuclear method) and the oven dried moisture contents determined in the laboratory in accordance with ASTM D2216.

Areas adjacent to existing pavement should be compacted per specification requirements so that a strip of poorly compacted soils is not left due to access limitations of the heavy equipment. Hand compaction equipment may be required to achieve adequate compaction levels along edges of new construction abutting existing pavement sections. This includes compaction of the (untreated) subgrade, and the treated subgrade.

9. Each construction area should be shaped to provide drainage of surface water. Surface water should not be allowed to pond. Surface water should be pumped immediately from each construction area after each rain and a firm subgrade maintained.
10. The moisture content and density within the completed subgrade shall be maintained during construction, until application of the prime coat has been completed, if applicable, or until the concrete pavement has been placed.

#### **6.1.4 Pavement Subgrade Treatment**

Site grading requirements were not completed at the time of this report. However, based on visual observations of the existing topography, it is assumed that relatively minor site grading (cuts and fills of less than about one (1) to three (3) feet) will generally be required to achieve finished grade for construction of the proposed improvements. Isolated areas may require additional site grading to facilitate surface water drainage improvements and new construction. Therefore, exposed subgrade soils are anticipated to consist of moderately to highly plastic (CL and CH) clay and silty clay soils, both fill and natural. It is recommended that the subgrade soils in all pavement areas be treated with stabilization additives to provide a firm, stable subgrade soil conditions for new pavement construction, minimize the potential

for piping beneath the pavement sections after construction, and increase the long term performance of the pavement sections.

**After the pavement areas have been brought to final subgrade elevation (prior to treatment operations), extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the exposed subgrade soils and additional analytical testing performed on selected subgrade samples to determine their concentrations of sulfates for evaluation of the potential for sulfate induced heave. Due to the isolated nature of soils containing high sulfate contents, as a minimum, analytical testing should be performed on the subgrade soils at a rate of at least one test per 100 linear feet along the alignment or a minimum of one test per 500 square yards of surface area, whichever is greater. Subgrade soils suitable for treatment operations shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method).**

Where possible, it is recommended that the subgrade soils be treated at least three (3) feet beyond the pavement edges (five (5) feet is preferred and should be considered for slip form paving operations). These extended limits should aid in providing a firm, stable, non-yielding working platform during construction, as well as aid in reducing pavement movements and cracking along the pavement edges due to seasonal moisture variations after construction.

#### **6.1.4.1 Lime Treatment of Clay Pavement Subgrade Soils**

Lime treatment of the pavement subgrade should be accomplished in accordance with the applicable provisions of Item P-155 of the latest change to the Federal Aviation Administration (FAA) Standards for Specifying Construction of Airports, AC 150/5370-10H, dated December 21, 2018 or Item 260 of the Texas Department of Transportation (TxDOT) Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, 2024. The pulverization and compaction requirements indicated below should be specified in lieu of the requirements recommended by the FAA and/or TxDOT. Strength testing of the lime treated subgrade soils, as outlined in TxDOT Item 260, may be omitted.

**After the pavement areas have been brought to final subgrade elevation (prior to treatment operations), extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the exposed subgrade soils and additional analytical testing performed on selected subgrade samples to determine their concentrations of sulfates for evaluation of the potential for sulfate induced heave. Due to the isolated nature of soils containing high sulfate contents, as a minimum, analytical testing should be performed on the subgrade soils at a rate of at least one test per 100 linear feet along the alignment or a minimum of one test per 500 square yards of surface area, whichever is greater. Subgrade soils suitable for treatment with chemical stabilization additives shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method) in accordance with TxDOT Guidelines.**

Lime should be added to the subgrade after removal of all surface vegetation and debris. A minimum of eight percent (8%) hydrated lime should be used to treat clay subgrade soils at

this site. The required application rate for an eight percent (8%) treatment depth of eight (8) inches is outlined below.

<u>Application (percent)</u>	<u>Depth of Treatment (inches)</u>	<u>Lime Required (pounds/square yard) *</u>
8	8	54

\* The recommended lime quantities have been adjusted to compensate for construction tolerances (non-uniformity) associated with lime spreading and rotary mixing.

Rotary mixing to depths in excess of those specified should be prohibited in order to prevent dilution of the required lime dosage. The mixing depths during construction should not be less than the specified depth of treatment and should be no more than one (1) inch deeper than the specified treatment depth.

Project specifications should allow a “mellowing” period between initial and final mixing of the lime treated soils. After initial mixing, the lime treated subgrade should be lightly rolled and maintained at or within 5 percentage points above the soil’s optimum moisture content until final mixing and compaction. We recommend a minimum 5-day “mellowing” period.

Approval of final mixing operations should be based on field gradation tests with at least 60 percent of the treated soil passing the No. 4 sieve at a moisture content near optimum, in accordance with TxDOT standards and as outlined below.

<u>Sieve Size</u>	<u>Minimum Percent Passing Respective Sieve</u>
1-3/4"	100%
3/4"	85%
#4	60%

Pulverization (field gradation) tests should be performed at the rate of at least one test per 1,000 square yards (SY) of surface area or a minimum of three (3) tests per construction area, whichever is greater.

The lime treated subgrade soils should be compacted to a minimum of 95 percent of the maximum dry density defined by the standard Proctor test (ASTM D698), at a moisture content within three percentage points ( $\pm 3\%$ ) of the optimum moisture value.

Areas adjacent to existing pavement should be compacted per specification requirements so that a strip of poorly compacted soils is not left due to access limitations of the heavy equipment. Hand compaction equipment may be required to achieve adequate compaction levels along edges of new construction abutting existing pavement sections and/or structure.

Verify compaction of pavement subgrade by in-place (nuclear) density tests (ASTM D6938) performed at the rate of at least one test per 1,000 square yards (SY) of surface area or a minimum of three (3) tests per construction area, whichever is greater.

At each in-place density test location, a representative sample of the treated subgrade soils shall be obtained and laboratory oven dried moisture content tests (ASTM D2216) performed to determine the moisture content of the subgrade soils. The dry density values used for evaluating compaction levels (percent density) shall be calculated based on the wet density values determined in the field in accordance with ASTM D6938 (nuclear method) and the oven dried moisture contents determined in the laboratory in accordance with ASTM D2216.

Untreated leveling sand should be specifically prohibited beneath pavement areas during final grading (after lime treatment), since these more porous soils can allow water inflow, resulting in strength loss of subgrade soils. It should be specified that only lime treated soil will be allowed for fine grading in accordance with TxDOT standards. After fine grading each area in preparation for paving, the subgrade surface should be lightly moistened, as needed, and recompact to obtain a tight non-yielding subgrade.

After blue top stakes have been set in preparation for fine grading, the depth of the treated subgrade should be measured to verify that the specified depth of treatment has been achieved below final pavement subgrade elevation. Verify thickness of the treated subgrade soils at the rate of at least one test per 1,000 square yards (SY) of surface area or a minimum of three (3) tests per construction area, whichever is greater.

It cannot be overemphasized that the mixing depths be monitored during construction in order to prevent dilution of the required cement dosage. The rotary mixing depth during construction should not be less than the specified depth of treatment and should be no more than one (1) inch deeper than the specified treatment depth.

The moisture content and density within the completed lime treated subgrade shall be maintained during construction, until application of the prime coat has been completed, if applicable, or until the pavement has been placed.

### **6.1.5 Pavement Subgrade Drainage**

Shallow groundwater levels are not desired for optimum pavement performance. Shallow groundwater levels cause pumping and strength loss of subgrade soils and premature deterioration of the pavement sections. At the time of our investigation (borings drilled December 5, 2025, after recent rainfall, but several years of prolonged periods of hot and dry (drought) summer and mild winter weather conditions), shallow groundwater seepage was not encountered in the borings during the drilling operations as indicated on the boring logs. However, shallow groundwater levels trapped within granular (aggregate) base materials causes strength loss of granular (aggregate) base materials, resulting in premature deterioration of the pavement sections.

Due to the presence of moderately to highly plastic (CL and CH) clay and silty clay soils at this site and the potential for trapping surface water within granular (aggregate) base layers, subgrade drainage systems should be provided adjacent to all pavement sections containing granular (aggregate) base materials, if applicable. The purpose of the subsurface drainage system is to intercept any surface water and/or groundwater seepage trapped (perched) within the adjacent granular (aggregate) base layers. Surface water has the potential of infiltrating

granular (aggregate) base materials through joints in the pavement, as well as along the pavement edges. When saturated, the granular (aggregate) base materials experience a significant reduction in their load bearing characteristics, resulting in premature deterioration of the pavement sections. Likewise, perched (trapped) water within the granular (aggregate) base materials cause swelling, as well as strength loss, of the underlying subgrade soils, ultimately resulting in premature deterioration of the pavement sections. In addition, in accordance with paragraph 3.16.3.5 of Advisory Circular AC 150/5320-6G, Airport Pavement Design and Evaluation, dated 6/7/2021, "Avoid producing a "sandwich section" in which one or more pervious granular layers is located between two impervious layers. This is to prevent trapping water in the granular layer, which could result in a loss of pavement strength and performance." The purpose of the subsurface drainage system is to intercept any surface water and/or groundwater seepage trapped (perched) within the adjacent granular (aggregate) base layers.

It is important to note that subsurface drains can be effective in improving subgrade drainage. However, subgrade drainage will not prevent future increases in the subgrade moisture content since all moisture infiltration cannot be intercepted. If the design sections are to include subgrade drainage improvements, it is recommended that subgrade drains be installed along the pavement edges in the areas identified above to depths of at least three (3) feet below final pavement subgrade. The subgrade drains shall be installed no greater than one (1) foot behind the back of curb. In addition, lateral drains should also be considered along the roadway alignments in order to intercept groundwater seepage beneath the pavement section. These lateral drains should be connected to the edge drain systems. The subgrade drains shall be sloped to allow gravity drainage to convenient discharge points. The subgrade drainage system may consist of a conventional french drain system or a manufactured edge drain system. If a manufactured edge drain system is used, the edge drains shall be installed in accordance with the manufacturer's recommendations. Due to the significant amounts of fines (silt and clay) present within the existing subsurface soils, a suitable filter fabric such as Mirafi 140N, or an approved equal, shall be placed between the free draining granular backfill and the existing soils to prevent migration of fines and possible eventual clogging of the drainage system. The extra layer of filter fabric shall be installed in addition to the filter fabric wrapping the perforated pipe (conventional french drain system) or the filter fabric provided for the manufactured edge drain systems. This design detail shall be utilized regardless of the type of edge drain construction.

## **6.2 Construction Considerations**

The contractor should be advised that groundwater seepage should be anticipated in the form of seepage through the cracks, fissures and fractures within the overburden clay soils, as well as discontinuities within on-site clay fill soils, particularly if construction occurs during or after periods of heavy rainfall.

## **6.3 Quality Assurance**

1. The suitability of select subgrade and concrete materials shall be verified by laboratory testing prior to installation at the jobsite.
2. The Moisture-Density Relationship (Proctor curves) of each material type shall be determined prior to compaction. Such tests typically require at least three (3) to five (5) days to complete.
3. **After the pavement areas have been brought to final subgrade elevation (prior to treatment operations), extensive visual observations shall be performed by an experienced Alliance Geotechnical Group, Inc. (AGG) Geotechnical Engineer on the**

**exposed subgrade soils and additional analytical testing performed on selected subgrade samples to determine their concentrations of sulfates for evaluation of the potential for sulfate induced heave. Due to the isolated nature of soils containing high sulfate contents, as a minimum, analytical testing should be performed on the subgrade soils at a rate of at least one test per 100 linear feet along the alignment or a minimum of one test per 500 square yards of surface area, whichever is greater. Subgrade soils suitable for treatment with chemical stabilization additives shall have sulfate concentrations of 3,000 parts per million (ppm) or less as determined by TxDOT Test Method Tex-145-E, Part II (Colorimetric Method) in accordance with TxDOT Guidelines.**

4. Pulverization (field gradation) tests should be performed on the treated subgrade soils at the rate of at least one test per 1,000 square yards of surface area or a minimum of three (3) tests per construction area, whichever is greater.
5. In-place (nuclear) density tests (ASTM D6938) should be performed at the following rates for each lift of material. Compliance with compaction specifications should be required prior to the placement of additional lifts.

**Paving Areas:**

Fill / Treated Subgrade: at least one (1) test per 1,000 square yards (SY) of surface area or a minimum of three (3) tests per construction area for each lift of material, whichever is greater.

**Utility Trench Backfill:**

at least one (1) test per 250 linear feet of trench for each lift or a minimum of two (2) tests per construction area for each lift of material, whichever is greater.

At each in-place density test location performed on the treated subgrade soils, a representative sample of the treated subgrade soils shall be obtained and laboratory oven dried moisture content tests (ASTM D2216) performed to determine the moisture content of the subgrade soils. The dry density values used for evaluating compaction levels (percent density) shall be calculated based on the wet density values determined in the field in accordance with ASTM D6938 (nuclear method) and the oven dried moisture contents determined in the laboratory in accordance with ASTM D2216.

6. After fine grading, verify thickness of the treated subgrade soils at the rate of at least one test per 1,000 square yards of surface area or a minimum of three (3) tests per construction area, whichever is greater.
7. One set of four (4) concrete test cylinders shall be cast along with one air test and one slump test per every 60 to 100 cubic yards or less, for each day's placement and shall be tested for compressive strength as indicated below. One (1) concrete test cylinder shall be tested 7 days after placement, while two (2) concrete test cylinders shall be tested 28 days after placement. One (1) concrete test cylinder shall be held (not tested), unless required for confirmation (verification) of companion 28-day concrete compressive strength results (within ASTM standards of acceptable test results for companion cylinders).

## **7. INSPECTION AND TESTING**

Many problems can be avoided or solved in the field if proper inspection and testing services are provided. It is recommended that all site and subgrade preparation, fill placement, and pavement construction be monitored by a qualified engineering technician. Density tests should be performed to verify compaction and moisture content of all earthwork. Inspection should be performed prior to and during concrete placement procedures. Alliance Geotechnical Group, Inc. employs a group of experienced, well-trained technicians for inspection and construction materials testing. We would be pleased to assist on this project phase.

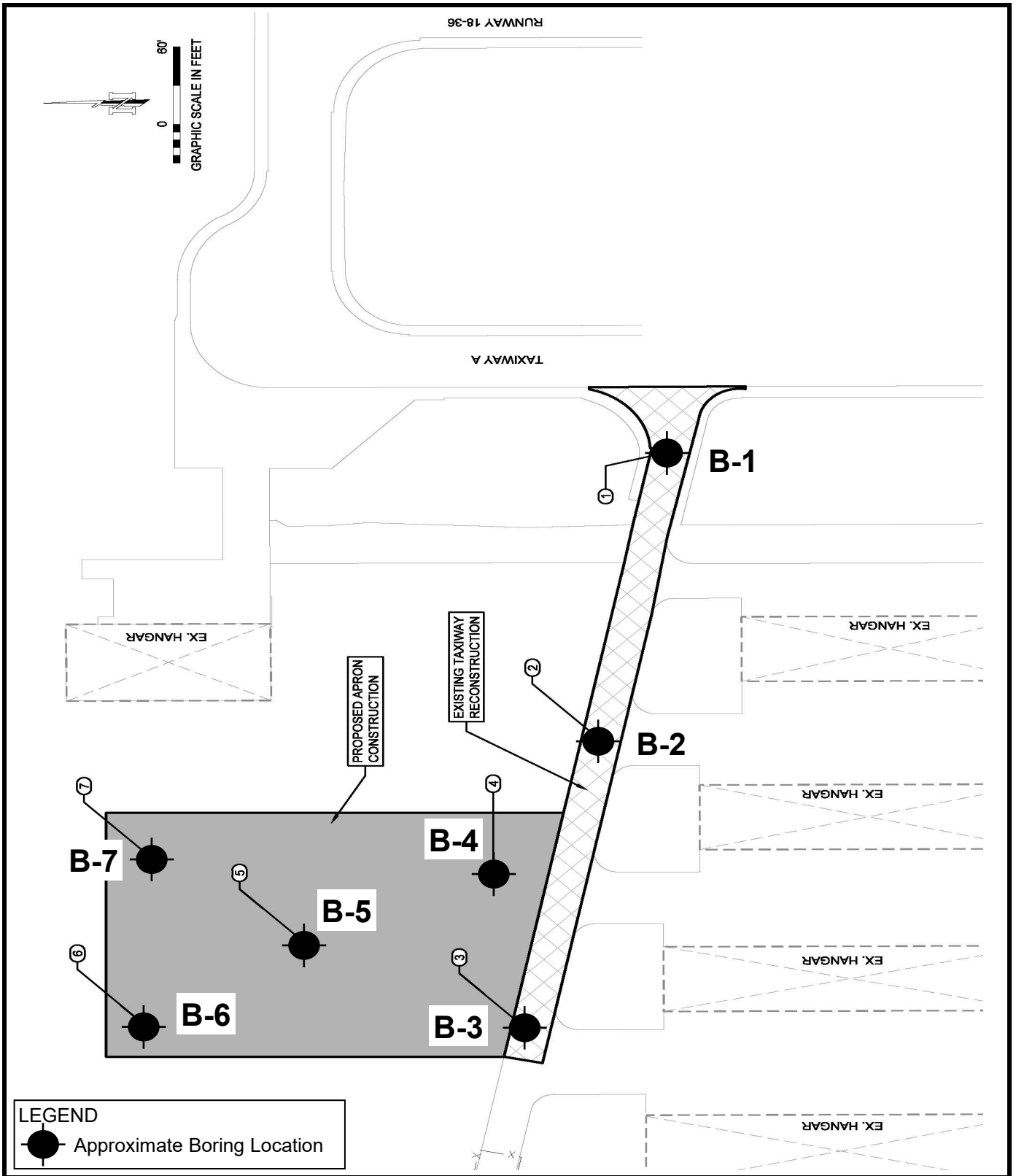
## **8. LIMITATIONS**

The professional services which have been performed, the findings obtained, and the recommendations prepared were accomplished in accordance with currently accepted geotechnical engineering principles and practices. The possibility always exists that the subsurface conditions at the site may vary somewhat from those encountered in the boreholes. The number and spacing of test borings were chosen in such a manner as to decrease the possibility of undiscovered abnormalities, while considering the nature of loading, size, and cost of the project. If there are any unusual conditions differing significantly from those described herein, Alliance Geotechnical Group, Inc. should be notified immediately so that the effects of these conditions on design and construction can be addressed.

This study was conducted for the exclusive use of KSA Engineers, Inc., the Mesquite Metro Airport, the City of Mesquite, Texas, the Texas Department of Transportation (TxDOT) Aviation Division, and their design consultants. The reproduction of this report or any part thereof, in plans or other documents supplied to persons other than the owner, should bear language indicating that the information contained therein is for general design purposes. All contractors referring to this geotechnical report should draw their own conclusions for bidding purposes. This report is intended to guide preparation of project specifications and should not be used as a substitute for the project specifications.

We will retain the samples acquired for this project for a period of 60 days subsequent to the submittal date printed on the report. After this period, the samples will be discarded unless otherwise notified by the client in writing.

**ILLUSTRATIONS**



TBPE Firm #1970  
317 W. Harrison Road  
Longview, Texas 75604  
(903) 759-5395

**Taxiway Reconstruction /  
Widening and  
Apron Construction  
Mesquite Metro Airport  
City of Mesquite, Texas**

**PLAN OF BORINGS**

Scale:  
As Shown


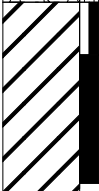
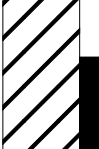
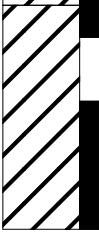
Project No.:  
LE25-022

**FIGURE  
NO.**

**1**

## LOG OF BORING BORING B-1

Project: **Taxiway Widening & Apron Construct.; Mesquite Metro A/P; City of Mesquite, TX**  
 Project No.: **LE25-022**                      Surface Elev.: **445.5±**                      Date Drilled: **12-5-25**  
 Location: **See Plan of Borings - Figure 1**    Northing: **6963118.77±**    Easting: **2573608.63±**  
 Depth to water at completion of boring: **Dry (Backfilled)**  
 Depth to water when checked: **N/A**                      was: **N/A**  
 Depth to caving when checked: **N/A**                      was: **N/A**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	P.PEN tsf	UNCON. tsf
0		14-1/8" PCC Pavement								
444		Stiff to very stiff dark gray CLAY w/ light gray & yellowish brown clay inclusions, calcareous nodules & inclusions	35 36	72	23	49	93	85.6	2.25 2.5 2.75	
3		-stiff below 5'								
441		(POSSIBLE FILL) (CH)							2.25	
6		Stiff to very stiff light gray CLAY w/ calcareous nodules & inclusions, iron stains & gray clay inclusions & layers								
438		-stiff below 8'	29	69	22	47	84		2.0 2.0 2.0	
9		(CH)								
435										
12										
432										
15										
429										
18										
426										

Notes: Completion Depth: 10'  
 Boring Backfilled with Soil Cuttings, Tamped and the Surface Patched Upon Completion.

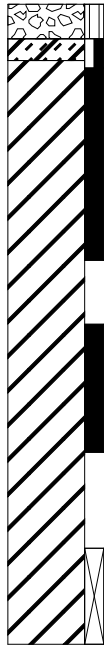
FIGURE NO.: 2

## LOG OF BORING BORING B-2

Project: **Taxiway Widening & Apron Construct.; Mesquite Metro A/P; City of Mesquite, TX**  
 Project No.: **LE25-022**                      Surface Elev.: **444.3±**                      Date Drilled: **12-5-25**  
 Location: **See Plan of Borings - Figure 1**    Northing: **6963162.60±**    Easting: **2573393.86±**  
 Depth to water at completion of boring: **Dry (Backfilled)**  
 Depth to water when checked: **N/A**                      was: **N/A**  
 Depth to caving when checked: **N/A**                      was: **N/A**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	P.PEN tsf	UNCON. tsf
444		6-1/2" PCC Pavement								
		4"± Treated Subgrade								
		Stiff to very stiff dark gray CLAY w/ numerous light gray & yellowish brown clay inclusions, calcareous nodules & inclusions	36 39	75	26	49	98	83.5	2.0 2.0 2.0 2.0	
441			35	78	24	54	97		2.0 2.0	
		-very stiff @ 5'-7'	32	71	23	48	98		2.5 2.5 3.0	
438										
		-w/ yellowish brown clay inclusions @ 9'	33	80	22	58	97			
435		-possible burnt wood fragments @ 10' (POSSIBLE FILL)                      (CH)								
432										
429										
426										

0  
444  
3  
441  
6  
438  
9  
435  
12  
432  
15  
429  
18  
426

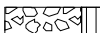
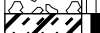
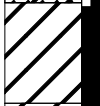
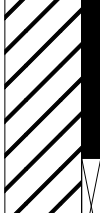
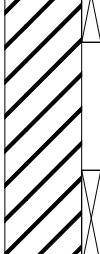


Notes: Completion Depth: 10'  
 Boring Backfilled with Soil Cuttings, Tamped and the Surface Patched Upon Completion.

FIGURE NO.: 3

## LOG OF BORING BORING B-3

Project: **Taxiway Widening & Apron Construct.; Mesquite Metro A/P; City of Mesquite, TX**  
 Project No.: **LE25-022**                      Surface Elev.: **443.7±**                      Date Drilled: **12-5-25**  
 Location: **See Plan of Borings - Figure 1**    Northing: **6963208.54±**    Easting: **2573169.33±**  
 Depth to water at completion of boring: **Dry (Backfilled)**  
 Depth to water when checked: **N/A**                      was: **N/A**  
 Depth to caving when checked: **N/A**                      was: **N/A**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	P.PEN tsf	UNCON. tsf
0		7-1/4" PCC Pavement								
		4"± Treated Subgrade								
441		Stiff to very stiff dark gray CLAY w/ light gray & yellowish brown clay inclusions, calcareous nodules & inclusions (POSSIBLE FILL) (CH)	32 34	74	24	50	97	89.0	2.0 2.5 2.0	
438		Stiff to very stiff light gray CLAY w/ calcareous nodules & inclusions, iron stains & gray clay inclusions & layers  -very stiff @ 4'-5'	29	71	23	48	94		2.0 2.0  2.25 2.25	
435		-w/ numerous calcareous nodules & inclusions below 6'	28	77	20	57	93			
432		(CH)	28	70	22	48	93			
429										
426										
423										

Notes: Completion Depth: 10'  
 Boring Backfilled with Soil Cuttings, Tamped and the Surface Patched Upon Completion.

FIGURE NO.: 4

## LOG OF BORING BORING B-4

Project: **Taxiway Widening & Apron Construct.; Mesquite Metro A/P; City of Mesquite, TX**  
 Project No.: **LE25-022**                      Surface Elev.: **444.3±**                      Date Drilled: **12-5-25**  
 Location: **See Plan of Borings - Figure 1**    Northing: **6963220.67±**    Easting: **2573293.88±**  
 Depth to water at completion of boring: **Dry (Backfilled)**  
 Depth to water when checked: **N/A**                      was: **N/A**  
 Depth to caving when checked: **N/A**                      was: **N/A**

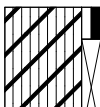
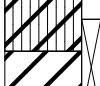
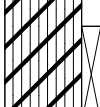
ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	P.PEN tsf	UNCON. tsf
444 0  3  6 438  9 435  12 432  15 429  18 426		Stiff dark gray CLAY w/ light gray & yellowish brown clay inclusions, calcareous nodules & inclusions  -very stiff below 2'  (POSSIBLE FILL)                      (CH)  Stiff light gray CLAY w/ calcareous nodules & inclusions, iron stains & occasional gray clay inclusions  (CH)	36  28  28  30	71  86  85  81	20  26  25  22	51  60  60  59	96  96  96  95	1.5 1.75 1.75 3.0 4.0 4.0 3.25 3.25 3.5		

Notes: Completion Depth: 10'  
 Boring Backfilled with Soil Cuttings and Tamped Upon Completion.

FIGURE NO.: 5

## LOG OF BORING BORING B-5

Project: **Taxiway Widening & Apron Construct.; Mesquite Metro A/P; City of Mesquite, TX**  
 Project No.: **LE25-022**                      Surface Elev.: **445.6±**                      Date Drilled: **12-5-25**  
 Location: **See Plan of Borings - Figure 1**    Northing: **6963336.50±**    Easting: **2573233.68±**  
 Depth to water at completion of boring: **Dry (Backfilled)**  
 Depth to water when checked: **N/A**                      was: **N/A**  
 Depth to caving when checked: **N/A**                      was: **N/A**

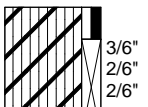
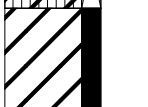




ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	P.PEN tsf	UNCON. tsf
0										
444		Medium stiff brown & gray silty CLAY, slightly sandy w/ gravel, calcareous nodules & dark gray clay seams, layers & pockets -3" dark gray clay layer @ 2' (FILL) (CL)	15	44	13	31	60			
3		Stiff dark gray CLAY w/ light gray & yellowish brown clay inclusions, calcareous nodules & inclusions  -very stiff below 6'  (POSSIBLE FILL) (CH)	36	80	23	57	98		1.75	
441			35	83	24	59	96		1.75	
6									2.25	
438			34	85	25	60	96		2.0	
9									2.25	
435			31	77	21	56	91		2.0	
12									2.0	
432		Stiff light gray & yellowish brown silty CLAY w/ calcareous nodules & inclusions, iron stains & occasional gray clay inclusions  (CH)	22	58	21	37	98			
15										
429										
18										
426										

Notes: Completion Depth: 15'  
 Boring Backfilled with Soil Cuttings and Tamped Upon Completion.

FIGURE NO.: 6

## LOG OF BORING BORING B-6

Project: **Taxiway Widening & Apron Construct.; Mesquite Metro A/P; City of Mesquite, TX**  
 Project No.: **LE25-022**                      Surface Elev.: **445.1±**                      Date Drilled: **12-5-25**  
 Location: **See Plan of Borings - Figure 1**    Northing: **6963447.29±**    Easting: **2573173.49±**  
 Depth to water at completion of boring: **Dry (Backfilled)**  
 Depth to water when checked: **N/A**                      was: **N/A**  
 Depth to caving when checked: **N/A**                      was: **N/A**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	P.PEN tsf	UNCON. tsf
0										
444		Medium stiff brown & gray silty CLAY, slightly sandy w/ gravel, calcareous nodules & dark gray clay seams, layers & pockets (FILL) (CH)	21	69	23	46	69			
3		Stiff dark gray CLAY w/ occasional light gray & yellowish brown clay inclusions, calcareous nodules & inclusions	35	81	23	58	98		1.5	
441		-very stiff below 4'							1.75	
6		(POSSIBLE FILL) (CH)	31	79	24	55	98		3.5	
438		Very stiff light gray CLAY w/ calcareous nodules & inclusions, iron stains & occasional gray clay inclusions							3.5	
9		(CH)	25	80	24	56	96		4.0	
435										
12										
432										
15										
429										
18										
426										

Notes: Completion Depth: 10'  
 Boring Backfilled with Soil Cuttings and Tamped Upon Completion.

FIGURE NO.: 7



## KEY TO LOG TERMS & SYMBOLS

Symbol Description

### Strata symbols



Portland Cement Concrete (PCC) Pavement Section



CLAY



Treated Subgrade



silty CLAY

### Soil Samplers



Pavement Core w/ Diamond Tipped Core Barrel



Auger



Shelby Tube



Standard Penetration Test (SPT)

### Notes:

1. Exploratory borings were drilled on dates indicated using standard truck-mounted drilling equipment.
2. Water level observations are noted on boring logs.
3. Results of laboratory tests conducted on samples recovered are reported on the boring logs.

Abbreviations used are:

MC = natural moisture content (%)	P.PEN. = hand penetrometer (tsf)
LL = liquid limit (%)	UNCON. = unconfined compression (tsf)
PL = plastic limit (%)	NP = Non-Plastic (PI=0)
PI = plasticity index (%)	NR = No Recovery
-200 = percent fines passing the #200 sieve (%)	W = Weight of Drill Rods & Hammer
D.D. = dry unit weight (pcf)	

FIGURE NO.: 9

## SUMMARY OF RESULTS

### EXISTING PAVEMENT SECTIONS ENCOUNTERED AT THE CORE / BORING LOCATIONS

Boring Number	Portland Cement Concrete Pavement (inch)	Treated Subgrade (inch) <sup>(3)</sup>	Subgrade Soils Immediately Beneath Pavement Section (Description)
B-1	14-1/8	--- <sup>(4)</sup>	Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)
B-2	6-1/2	4±	Dark Gray CLAY w/ Numerous Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)
B-3	7-1/4	4±	Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)

**NOTES:**

- (1) The components of the existing pavement sections were carefully measured during field operations performed on 12/5/25.
- (2) The results of all field measurements are included on the boring logs, Figures 2 through 4, and are summarized herein. In addition, detailed descriptions and observations of the pavement sections, as well as photographs of the respective pavement cores, are included in the Appendix of this report.
- (3) Phenolphthalein indicator used to identify the presence of stabilization additives.
- (4) Based on visual examination of the subgrade soils immediately below the pavement section using phenolphthalein, the subgrade soils encountered beneath the pavement sections do not appear to have been treated with stabilization additives (not detectable using phenolphthalein indicator).

FIGURE NO.: 10

## SUMMARY OF RESULTS

### SULFATE CONTENT IN SOILS – COLORIMETRIC METHOD (TEX-145-E, PART II)

Boring Number	Depth (ft)	Material Description	Sulfate Content (PPM)
B-1	2 – 3	Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)	< 100
B-2	1 - 2	Dark Gray CLAY w/ Numerous Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)	< 100
B-3	1 - 2	Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)	< 100
B-4	0.5 - 2	Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)	< 100
B-5	0.5 - 1	Brown & Gray Silty CLAY, Slightly Sandy w/ Gravel, Calcareous Nodules & Dark Gray Clay Seams, Layers & Pockets (FILL) (CL)	< 100
B-5	3.5 - 4	Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)	< 100
B-6	0.5 - 1	Brown & Gray Silty CLAY, Slightly Sandy w/ Gravel, Calcareous Nodules & Dark Gray Clay Seams, Layers & Pockets (FILL) (CL)	< 100
B-7	0.5 - 1	Dark Gray CLAY w/ Occasional Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)	< 100

**NOTE:** Large detectable gypsiferous crystals were generally not detected during visual examination of the test samples. According to the Texas Department of Transportation (TxDOT) Treatment Guidelines for Soils and Bases in Pavement Structures, dated August 2019, research and field experience have shown that soils with sulfate levels of 3,000 ppm or less pose low potential for sulfate induced heave. Standard construction and mix design practices, as specified in Item 260 and/or Item 275 of the Texas Department of Transportation (TxDOT) Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, 2024 Edition, can be utilized to treat soils exhibiting sulfate concentrations below 3,000 ppm. Modified construction methods must be followed to treat soils exhibiting sulfate concentrations greater than 3,000 ppm but less than or equal to 7,000 ppm in order to ensure the prevention and mitigation of sulfate heave. For soils with sulfate contents higher than 7,000 ppm, the normal recommendation is to remove and replace. Since high concentrations of sulfates can be very isolated across a site, visual observations shall be performed on the exposed subgrade soils and extensive analytical testing should be performed after the pavement areas have been brought to final subgrade elevation (prior to stabilization operations).

FIGURE NO.: 11

## SUMMARY OF RESULTS

### ONE DIMENSIONAL SWELL TESTS (ASTM D4546, METHOD B)

Test Number	1	2
Boring Number	B-1	B-1
Depth, ft	2-3	2-3
Soil Type <sup>(1)</sup>	A	A
Moisture Condition <sup>(2)</sup>	In-Situ	Air Dried
Liquid Limit, %	72	72
Plastic Limit, %	23	23
Plasticity Index (PI), %	49	49
Percent Finer than #200 Sieve, %	93.1	93.1
Dry Unit Weight, pcf	85.6	99.8
Initial Moisture Content, %	34.5	25.0
Final Moisture Content, %	36.2	33.5
Initial Penetrometer Reading, tsf	2.25	4.5+
Final Penetrometer Reading, tsf	2.00	1.50
Overburden Swell Pressure, psf	313	313
<b>Vertical Swell, %</b>	<b>0.99</b>	<b>9.10</b>

#### NOTES:

- (1) Soil Type A: Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)
- (2) Due to the relatively moist condition of the subsurface clay soils at the time of our investigation, in order to provide additional information about the swell characteristics of these clay soils, swell tests were performed on selected samples of the clay soils at both the samples "in-situ" moisture condition (moisture content at the time of our investigation) to evaluate swell potential at the time of our investigation, and in an "air dried" condition to simulate dry soil conditions.

FIGURE NO.: 12

## SUMMARY OF RESULTS

### ONE DIMENSIONAL SWELL TESTS (ASTM D4546, METHOD B)

Test Number	3	4
Boring Number	B-2	B-2
Depth, ft	1-2	1-2
Soil Type <sup>(1)</sup>	A	A
Moisture Condition <sup>(2)</sup>	In-Situ	Air Dried
Liquid Limit, %	75	75
Plastic Limit, %	26	26
Plasticity Index (PI), %	49	49
Percent Finer than #200 Sieve, %	98.1	98.1
Dry Unit Weight, pcf	83.5	98.6
Initial Moisture Content, %	39.0	26.3
Final Moisture Content, %	40.3	37.2
Initial Penetrometer Reading, tsf	2.00	4.5+
Final Penetrometer Reading, tsf	1.50	1.50
Overburden Swell Pressure, psf	188	188
<b>Vertical Swell, %</b>	<b>0.17</b>	<b>16.08</b>

#### NOTES:

- (1) Soil Type A: Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)
- (2) Due to the relatively moist condition of the subsurface clay soils at the time of our investigation, in order to provide additional information about the swell characteristics of these clay soils, swell tests were performed on selected samples of the clay soils at both the samples "in-situ" moisture condition (moisture content at the time of our investigation) to evaluate swell potential at the time of our investigation, and in an "air dried" condition to simulate dry soil conditions.

FIGURE NO.: 13

## SUMMARY OF RESULTS

### ONE DIMENSIONAL SWELL TESTS (ASTM D4546, METHOD B)

Test Number	5	6
Boring Number	B-3	B-3
Depth, ft	1-2	1-2
Soil Type <sup>(1)</sup>	A	A
Moisture Condition <sup>(2)</sup>	In-Situ	Air Dried
Liquid Limit, %	74	74
Plastic Limit, %	24	24
Plasticity Index (PI), %	50	50
Percent Finer than #200 Sieve, %	96.8	96.8
Dry Unit Weight, pcf	89.0	101.1
Initial Moisture Content, %	33.7	23.7
Final Moisture Content, %	35.1	33.9
Initial Penetrometer Reading, tsf	2.50	4.5+
Final Penetrometer Reading, tsf	2.00	1.50
Overburden Swell Pressure, psf	188	188
<b>Vertical Swell, %</b>	<b>1.33</b>	<b>15.07</b>

#### NOTES:

- (1) Soil Type A: Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions (POSSIBLE FILL) (CH)
- (2) Due to the relatively moist condition of the subsurface clay soils at the time of our investigation, in order to provide additional information about the swell characteristics of these clay soils, swell tests were performed on selected samples of the clay soils at both the samples "in-situ" moisture condition (moisture content at the time of our investigation) to evaluate swell potential at the time of our investigation, and in an "air dried" condition to simulate dry soil conditions.

FIGURE NO.: 14

## SUMMARY OF RESULTS

### ATTERBERG LIMIT DETERMINATION ON LIME STABILIZED SOILS

Location: B-2  
Depth: 1' – 2'  
Description: Dark gray CLAY w/ numerous light gray & yellowish brown clay inclusions, calcareous nodules & inclusions (POSSIBLE FILL) (CH)

<u>LIME CONTENT (%)</u>	<u>LIQUID LIMIT (%)</u>	<u>PLASTIC LIMIT (%)</u>	<u>PLASTICITY INDEX (PI)</u>
0	75	26	49
4	69	37	32
6	64	45	18
8	61	48	13
10	60	48	12

Location: B-4  
Depth: 0.5' – 2'  
Description: Dark gray CLAY w/ light gray & yellowish brown clay inclusions, calcareous nodules & inclusions (POSSIBLE FILL) (CH)

<u>LIME CONTENT (%)</u>	<u>LIQUID LIMIT (%)</u>	<u>PLASTIC LIMIT (%)</u>	<u>PLASTICITY INDEX (PI)</u>
0	71	20	51
4	65	39	26
6	60	43	17
8	58	46	12
10	58	47	11

FIGURE NO.: 15

## SUMMARY OF RESULTS

### ATTERBERG LIMIT DETERMINATION ON LIME STABILIZED SOILS

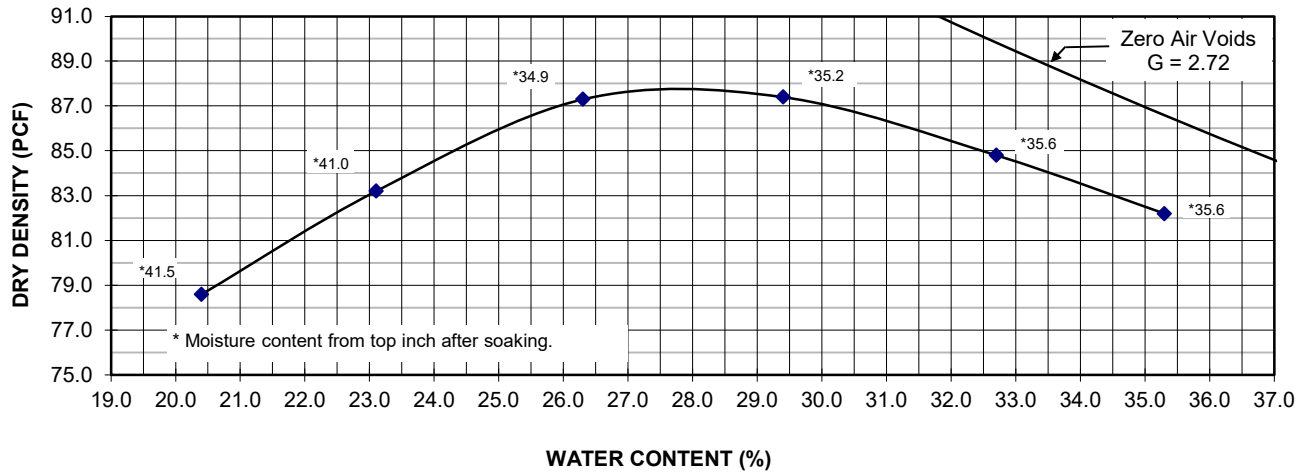
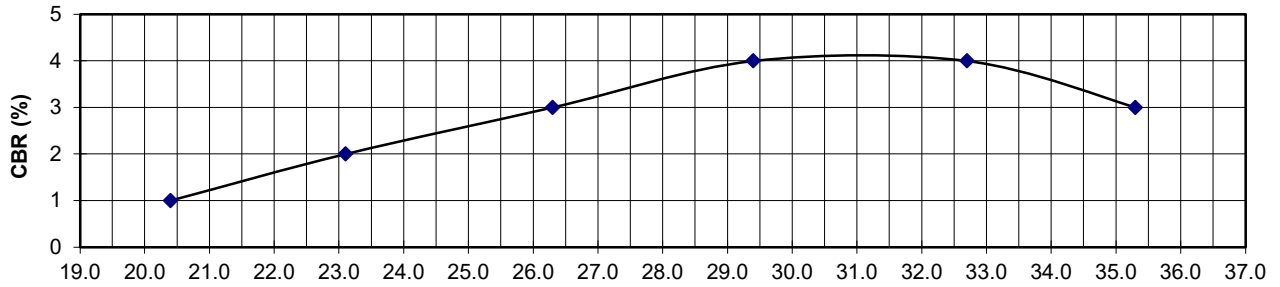
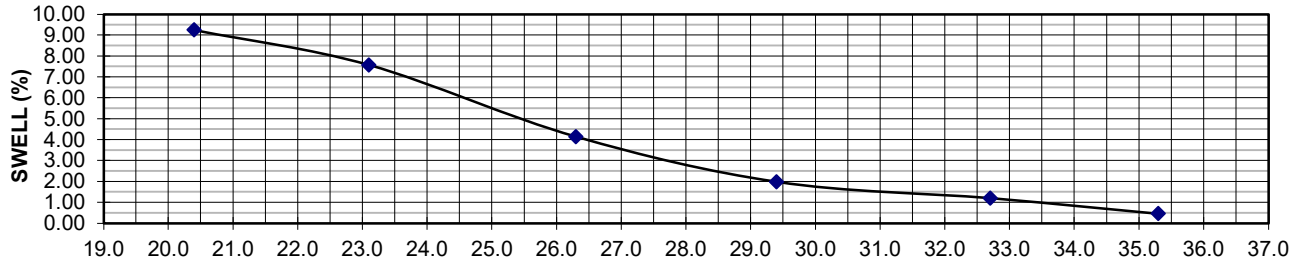
Location: B-7  
Depth: 0.5' – 2'  
Description: Dark gray CLAY w/ occasional light gray & yellowish brown clay inclusions, calcareous nodules & inclusions (POSSIBLE FILL) (CH)

<u>LIME CONTENT (%)</u>	<u>LIQUID LIMIT (%)</u>	<u>PLASTIC LIMIT (%)</u>	<u>PLASTICITY INDEX (PI)</u>
0	76	22	54
4	69	36	33
6	59	40	19
8	56	42	14
10	56	44	12

FIGURE NO.: 16

# CALIFORNIA BEARING RATIO (CBR) TEST REPORT

## CBR-1 - AGG SAMPLE NO. 5034



California Bearing Ratio ASTM D 1883

Approximate Location	Elev./ Depth	Classification	Atterberg Limits ASTM D 4318			% Passing	
		USCS	LL	PL	PI	No. 4	No. 200
B-1 thru B-7	1' - 5'±	CH	77	21	56	99 (est.)	95.5

Proctor Test Results ASTM D 698, Method C

Optimum Moisture = 27.8 %  
Maximum Dry Density = 87.8 pcf

Material Description

Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions

AGG REPORT NO.: LE25-022

DATE: 12/29/26

PROJECT: Proposed New Apron and Taxiway Reconstruction  
Mesquite Metro Airport  
City of Mesquite, Texas

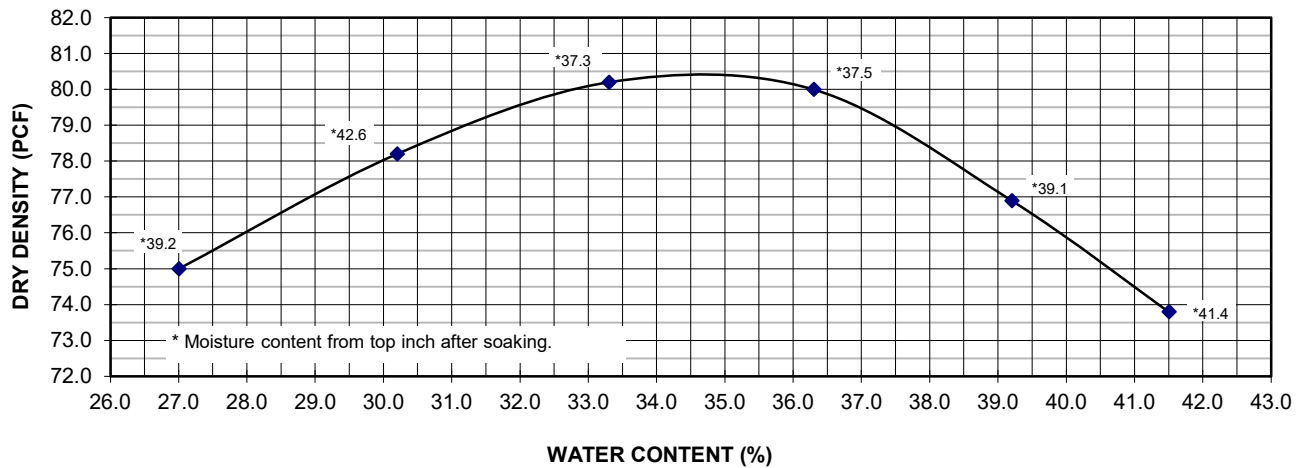
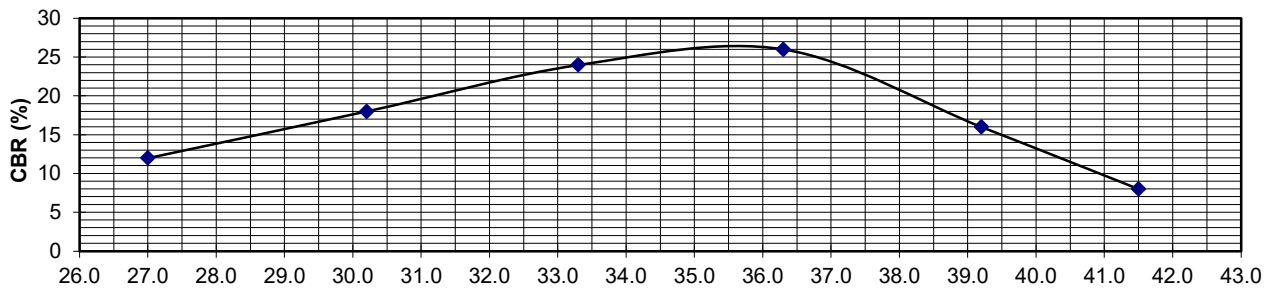
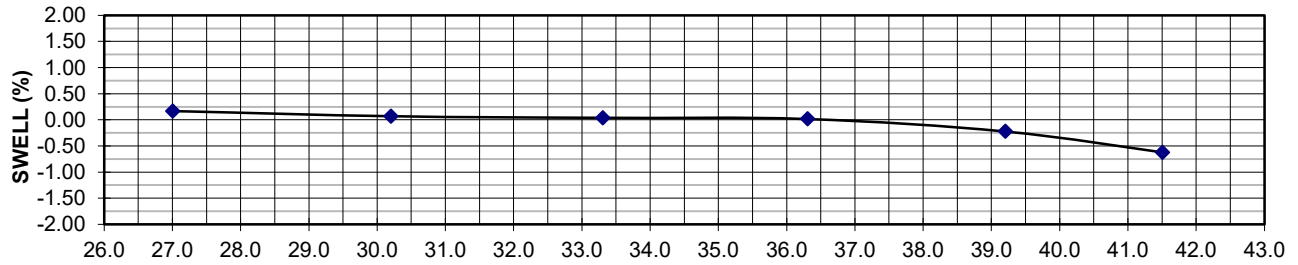
REMARKS:

Bulk sample specimens were soaked for 4 days and penetrated under a 25 pound surcharge.



# CALIFORNIA BEARING RATIO (CBR) TEST REPORT

## CBR-1 - AGG SAMPLE NO. 5034 (LIME TREATED)



### California Bearing Ratio ASTM D 1883

Approximate Location	Elev./ Depth	Classification	Atterberg Limits ASTM D 4318			% Passing	
		USCS	LL	PL	PI	No. 4	No. 200
B-1 thru B-7	1' - 5'±	CH	52	46	6	99 (est.)	N/A

### Proctor Test Results ASTM D 698, Method C

Optimum Moisture = 34.6 %  
Maximum Dry Density = 80.7 pcf

### Material Description

Lime Treated (6% - Lab Mixed) Dark Gray CLAY w/ Light Gray & Yellowish Brown Clay Inclusions, Calcareous Nodules & Inclusions

AGG REPORT NO.: LE25-022                      DATE: 1/6/26  
PROJECT: Proposed New Apron and Taxiway Reconstruction  
Mesquite Metro Airport  
City of Mesquite, Texas

REMARKS:  
Bulk sample specimens were soaked for 4 days and penetrated under a 25 pound surcharge.



**APPENDIX**

**PAVEMENT CORE REPORTS**

## BORING/CORE NO.: B-1



### CORE LAYER DATA (FROM TOP TO BOTTOM)

Sample No.	Layer No.	Layer Type	Layer Thickness (in.)	Remarks
1	1	Portland Cement Concrete	14-1/8	
		Total Pavement Thickness	14-1/8	
2	2	Subgrade (Untreated)  (See Log of Boring)		-Dark gray CLAY w/ light gray & yellowish brown clay inclusions, calcareous nodules & inclusions (POSSIBLE FILL) (CH)

### CORE DATA

Surface Material Type:     A.C.     P.C.C.     Continuously Reinforced Concrete

Stripping or Separation in Asphalt:     Stripping     Separation     N/A

Honeycomb or "D" Cracking in PCC:     Honeycomb     "D" Cracking     N/A

Treated Subgrade Beneath Pavement/Base or Subbase?     Yes     No     Unknown

FIGURE NO.: A-1

## BORING/CORE NO.: B-2



### CORE LAYER DATA (FROM TOP TO BOTTOM)

Sample No.	Layer No.	Layer Type	Layer Thickness (in.)	Remarks
1	1	Portland Cement Concrete	6-1/2	
		Total Pavement Thickness	6-1/2	
2	2	Treated Subgrade (Clay)	4±	-Treated Subgrade (Hard)
3	3	Subgrade (Untreated)  (See Log of Boring)		-Dark gray CLAY w/ numerous light gray & yellowish brown clay inclusions, calcareous nodules & inclusions (POSSIBLE FILL) (CH)

### CORE DATA

Surface Material Type:     A.C.     P.C.C.     Continuously Reinforced Concrete

Stripping or Separation in Asphalt:     Stripping     Separation     N/A

Honeycomb or "D" Cracking in PCC:     Honeycomb     "D" Cracking     N/A

Treated Subgrade Beneath Pavement/Base or Subbase?     Yes     No     Unknown

FIGURE NO.: A-2

## BORING/CORE NO.: B-3



### CORE LAYER DATA (FROM TOP TO BOTTOM)

Sample No.	Layer No.	Layer Type	Layer Thickness (in.)	Remarks
1	1	Portland Cement Concrete	7-1/4	
		Total Pavement Thickness	7-1/4	
2	2	Treated Subgrade (Clay)	4±	-Treated Subgrade (Hard)
3	3	Subgrade (Untreated)  (See Log of Boring)		-Dark gray CLAY w/ light gray & yellowish brown clay inclusions, calcareous nodules & inclusions (POSSIBLE FILL) (CH)

### CORE DATA

Surface Material Type:     A.C.     P.C.C.     Continuously Reinforced Concrete

Stripping or Separation in Asphalt:     Stripping     Separation     N/A

Honeycomb or "D" Cracking in PCC:     Honeycomb     "D" Cracking     N/A

Treated Subgrade Beneath Pavement/Base or Subbase?     Yes     No     Unknown

FIGURE NO.: A-3

# **DRAWING INDEX**

<b>SHEET INDEX</b>	
<b>SHEET NUMBER</b>	<b>SHEET TITLE</b>
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G01	COVER SHEET
G02	SHEET INDEX AND SUMMARY OF QUAUNTITIES
G03	GENERAL NOTES
G04	BORE LOGS
G05	CONSTRUCTION SAFETY PHASING PLAN I
G06	CONSTRUCTION SAFETY PHASING PLAN II
<b>CIVIL SHEETS</b>	
C01	PROJECT LAYOUT
C02	PHASING PLAN - PHASE 1A
C03	PHASING PLAN - PHASE 1B
C04	PHASING DETAILS
C05	DEMOLITION PLAN
C06	PAVING PLAN
C07	PAVING DETAILS I
C08	PAVING DETAILS II
C09	JOINTING PLAN
C10	JOINTING DETAILS I
C11	JOINTING DETAILS II
C12	GRADING PLAN (BASE BID)
C13	GRADING PLAN (WITH ALTERNATE 1)
C14	GRADING PLAN (WITH ALTERNATES 1-2)
C15	TAXILANE PLAN AND PROFILE I
C16	TAXILANE PLAN AND PROFILE II
C17	EXISTING DRAINAGE AREA MAP
C18	PROPOSED DRAINAGE AREA MAP
C19	DRAINAGE CALCULATIONS
C20	STORM LINE A PLAN AND PROFILE
C21	STORM LINE B PLAN AND PROFILE
C22	STORM DETAILS I
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C24	APRON SPOT ELEVATIONS
C25	SPOT ELEVATION TABLES
C26	EROSION CONTROL PLAN
C27	STORMWATER POLLUTION PREVENTION PLAN
C28	EROSION CONTROL DETAILS I
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C30	MARKING PLAN
C31	MARKING DETAILS
<b>ELECTRICAL SHEETS</b>	
E01	TAXILANE ELECTRICAL LAYOUT PLAN
E02	ELECTRICAL DETAILS