

|         |                 |
|---------|-----------------|
| Control | 6400-73-001     |
| Project | RMC - 640073001 |
| Highway | US0067          |
| County  | COMANCHE        |

## ADDENDUM ACKNOWLEDGMENT

**Each bidder is required to acknowledge receipt of an addendum issued for a specific project. This page is provided for the purpose of acknowledging an addendum.**

FAILURE TO ACKNOWLEDGE RECEIPT OF AN ADDENDUM WILL RESULT IN THE BID NOT BEING READ.

In order to properly acknowledge an addendum place a mark in the box next to the respective addendum.

- ADDENDUM NO. 1
- ADDENDUM NO. 2
- ADDENDUM NO. 3
- ADDENDUM NO. 4
- ADDENDUM NO. 5

In addition, the bidder by affixing their signature to the signature page of the proposal is acknowledging that they have taken the addendum(s) into consideration when preparing their bid and that the information contained in the addendum will be included in the contract, if awarded by the Commission or other designees.

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|         |                 |
|---------|-----------------|
| Control | 6400-73-001     |
| Project | RMC - 640073001 |
| Highway | US0067          |
| County  | COMANCHE        |

# PROPOSAL TO THE TEXAS TRANSPORTATION COMMISSION

## 2014 SPECIFICATIONS

### WORK CONSISTING OF MILL AND INLAY

### COMANCHE COUNTY, TEXAS

The quantities in the proposal are approximate. The quantities of work and materials may be increased or decreased as considered necessary to complete the work as planned and contemplated.

This project is to be completed in 22 working days and will be accepted when fully completed and finished to the satisfaction of the Executive Director or designee.

Provide a proposal guaranty in the form of a Cashier's Check, Teller's Check (including an Official Check) or Bank Money Order on a State or National Bank or Savings and Loan Association, or State or Federally chartered Credit Union made payable to the Texas Transportation Commission in the following amount:

TWELVE THOUSAND (Dollars) ( \$12,000 )

A bid bond may be used as the required proposal guaranty. The bond form may be detached from the proposal for completion. The proposal may not be disassembled to remove the bond form. The bond must be in accordance with Item 2 of the specifications.

Any addenda issued amending this proposal and/or the plans that have been acknowledged by the bidder, become part of this proposal.

By signing the proposal the bidder certifies:

1. the only persons or parties interested in this proposal are those named and the bidder has not directly or indirectly participated in collusion, entered into an agreement or otherwise taken any action in restraint of free competitive bidding in connection with the above captioned project.
2. in the event of the award of a contract, the organization represented will secure bonds for the full amount of the contract.
3. the signatory represents and warrants that they are an authorized signatory for the organization for which the bid is submitted and they have full and complete authority to submit this bid on behalf of their firm.
4. that the certifications and representations contained in the proposal are true and accurate and the bidder intends the proposal to be taken as a genuine government record.

• **Signed:** \*\*

(1) \_\_\_\_\_ (2) \_\_\_\_\_ (3) \_\_\_\_\_

**Print Name:**

(1) \_\_\_\_\_ (2) \_\_\_\_\_ (3) \_\_\_\_\_

**Title:**

(1) \_\_\_\_\_ (2) \_\_\_\_\_ (3) \_\_\_\_\_

**Company:**

(1) \_\_\_\_\_ (2) \_\_\_\_\_ (3) \_\_\_\_\_

- Signatures to comply with Item 2 of the specifications.

\*\*Note: Complete (1) for single venture, through (2) for joint venture and through (3) for triple venture.

\* **When the working days field contains an asterisk (\*) refer to the Special Provisions and General Notes.**

## **NOTICE TO CONTRACTORS**

**ANY CONTRACTORS INTENDING TO BID ON ANY WORK TO BE AWARDED BY THIS DEPARTMENT MUST SUBMIT A SATISFACTORY “AUDITED FINANCIAL STATEMENT” AND “EXPERIENCE QUESTIONNAIRE” AT LEAST TEN DAYS PRIOR TO THE LETTING DATE.**

**UNIT PRICES MUST BE SUBMITTED IN ACCORDANCE WITH ITEM 2 OF THE STANDARD SPECIFICATIONS OR SPECIAL PROVISION TO ITEM 2 FOR EACH ITEM LISTED IN THIS PROPOSAL.**

# TEXAS DEPARTMENT OF TRANSPORTATION

## BID BOND

KNOW ALL PERSONS BY THESE PRESENTS,

That we, (Contractor Name) \_\_\_\_\_  
\_\_\_\_\_

Hereinafter called the Principal, and (Surety Name) \_\_\_\_\_  
\_\_\_\_\_

a corporation or firm duly authorized to transact surety business in the State of Texas, hereinafter called the Surety, are held and firmly bound unto the Texas Department of Transportation, hereinafter called the Oblige, in the sum of not less than two percent (2%) of the department's engineer's estimate, rounded to the nearest one thousand dollars, not to exceed one hundred thousand dollars (\$100,000) as a proposal guaranty (amount displayed on the cover of the proposal), the payment of which sum will and truly be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the principal has submitted a bid for the following project identified as:

|                |                        |
|----------------|------------------------|
| <b>Control</b> | <b>6400-73-001</b>     |
| <b>Project</b> | <b>RMC - 640073001</b> |
| <b>Highway</b> | <b>US0067</b>          |
| <b>County</b>  | <b>COMANCHE</b>        |

NOW, THEREFORE, if the Oblige shall award the Contract to the Principal and the Principal shall enter into the Contract in writing with the Oblige in accordance with the terms of such bid, then this bond shall be null and void. If in the event of failure of the Principal to execute such Contract in accordance with the terms of such bid, this bond shall become the property of the Oblige, without recourse of the Principal and/or Surety, not as a penalty but as liquidated damages.

Signed this \_\_\_\_\_ Day of \_\_\_\_\_ 20\_\_\_\_\_

By: \_\_\_\_\_  
(Contractor/Principal Name)

\_\_\_\_\_  
(Signature and Title of Authorized Signatory for Contractor/Principal)

\*By: \_\_\_\_\_  
(Surety Name)

\_\_\_\_\_  
(Signature of Attorney-in-Fact)

Impressed  
Surety Seal  
Only

\*Attach Power of attorney (Surety) for Attorney-in-Fact

**This form may be removed from the proposal.**

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# BIDDER'S CHECK RETURN

## IMPORTANT

The space provided for the return address must be completed to facilitate the return of your bidder's check. Care must be taken to provide a legible, accurate, and complete return address, including zip code. A copy of this sheet should be used for each different return address.

## NOTE

Successful bidders will receive their guaranty checks with the executed contract.

RETURN BIDDERS CHECK TO (PLEASE PRINT):

|  |
|--|
|  |
|  |
|  |

|                |                        |
|----------------|------------------------|
| <b>Control</b> | <b>6400-73-001</b>     |
| <b>Project</b> | <b>RMC - 640073001</b> |
| <b>Highway</b> | <b>US0067</b>          |
| <b>County</b>  | <b>COMANCHE</b>        |

## IMPORTANT

### PLEASE RETURN THIS SHEET IN ITS ENTIRETY

Please acknowledge receipt of this check(s) at your earliest convenience by signing below in longhand, in ink, and returning this acknowledgement in the enclosed self addressed envelope.

Check Received By: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_

For (Contractor's Name): \_\_\_\_\_

Project \_\_\_\_\_ County \_\_\_\_\_

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## NOTICE TO THE BIDDER

In the space provided below, please enter your total bid amount for this project. Only this figure will be read publicly by the Department at the public bid opening.

It is understood and agreed by the bidder in signing this proposal that the total bid amount entered below is not binding on either the bidder or the Department. It is further agreed that **the official total bid amount for this proposal will be determined by multiplying the unit bid prices for each pay item by the respective estimated quantities shown in this proposal and then totaling all of the extended amounts.**

\$ \_\_\_\_\_  
**Total Bid Amount**

Control 0001-03-030  
 Project STP 2000(938)HES  
 Highway SH 20  
 County EL PASO

| ALT              | ITEM | DESC | SP | Bid Item Description | Unit | Quantity | Bid Price | Amount     | Seq |
|------------------|------|------|----|----------------------|------|----------|-----------|------------|-----|
|                  | I04  | 509  | X  | REMOV CONC (SDWLK)   | MSY  | 266.400  | \$10.000  | \$2,664.00 | 1   |
| Total Bid Amount |      |      |    |                      |      |          |           | \$2,664.00 |     |

Signed \_\_\_\_\_  
 Title \_\_\_\_\_  
 Date \_\_\_\_\_

Additional Signature for Joint Venture:

Signed \_\_\_\_\_  
 Title \_\_\_\_\_  
 Date \_\_\_\_\_

**EXAMPLE OF BID PRICES SUBMITTED BY COMPUTER PRINTOUT**

EXAMPLE

EXAMPLE

EXAMPLE

EXAMPLE

# EXAMPLES

## BID PRICES SUBMITTED BY HAND WRITTEN FORMAT

| ALT | ITEM-CODE  |            |             | UNIT BID PRICE <u>ONLY</u><br>WRITTEN IN WORDS | UNIT | APPROX<br>QUANTITIES | DEPT<br>USE<br>ONLY |
|-----|------------|------------|-------------|--|------|----------------------|---------------------|
|     | ITEM<br>NO | DESC<br>NO | S.P.<br>NO. |  |      |                      |                     |
|     | 190        | 026        |             | RED OAK 1 1/2 - 1 3/4 GAL BB                   | EA   | 9.000                | 1                   |
|     |            |            |             |  | L    | E                    |                     |

**Unit price for each plant in place**

|  |     |     |  |                                      |     |           |    |
|--|-----|-----|--|--------------------------------------|-----|-----------|----|
|  | 249 | 014 |  | FLEX BASE(DEL)(DENSOT)(TY A GR4 CL2) | TON | 56,787.00 | 14 |
|  |     |     |  |                                      | L   | E         |    |

**Unit price for each ton of Flexible Base**

|  |     |     |     |                              |    |        |    |
|--|-----|-----|-----|------------------------------|----|--------|----|
|  | 430 | 001 | 001 | CL A CONC FOR EXT STR (CULV) | CY | 45.000 | 27 |
|  |     |     |     |                              | L  | E      |    |

**Unit price for each cubic yard of Concrete**

|  |     |     |     |                                       |    |        |   |
|--|-----|-----|-----|---------------------------------------|----|--------|---|
|  | 610 | 007 | 001 | RDWY ILL ASSEM(TY ST 50T-8-8)(.4 KW)S | EA | 13.000 | 7 |
|  |     |     |     |                                       | L  | E      |   |

**Unit price of each Roadway Illumination Assembly**

EXAMPLE

EXAMPLE

EXAMPLE

EXAMPLE

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PROJECT RMC - 640073001  
 COUNTY COMANCHE

Proposal Sheet  
 TxDOT  
 FORM 234-B I-61-5M

| ALT | ITEM-CODE  |              |             | UNIT BID PRICE ONLY.<br>WRITTEN IN WORDS                               | UNIT | APPROX<br>QUANTITIES | DEPT<br>USE<br>ONLY |
|-----|------------|--------------|-------------|--|------|----------------------|---------------------|
|     | ITEM<br>NO | DESC<br>CODE | S.P.<br>NO. |  |      |                      |                     |
|     | 354        | 6002         |             | PLAN & TEXT ASPH CONC PAV(0" TO 2")<br>DOLLARS<br>and<br>CENTS         | SY   | 24,060.000           | 1                   |
|     | 500        | 6001         |             | MOBILIZATION<br>DOLLARS<br>and<br>CENTS                                | LS   | 1.000                | 2                   |
|     | 502        | 6001         | 008         | BARRICADES, SIGNS AND TRAFFIC HAN-<br>DLING<br>DOLLARS<br>and<br>CENTS | MO   | 2.000                | 3                   |
|     | 662        | 6109         |             | WK ZN PAV MRK SHT TERM (TAB)TY W<br>DOLLARS<br>and<br>CENTS            | EA   | 1,464.000            | 4                   |
|     | 662        | 6111         |             | WK ZN PAV MRK SHT TERM (TAB)TY Y-2<br>DOLLARS<br>and<br>CENTS          | EA   | 1,184.000            | 5                   |
|     | 3077       | 6034         |             | SP MIXES SP-C SAC-B PG76-22<br>DOLLARS<br>and<br>CENTS                 | TON  | 2,767.000            | 6                   |
|     | 3084       | 6001         |             | BONDING COURSE<br>DOLLARS<br>and<br>CENTS                              | GAL  | 3,368.000            | 7                   |
|     | 6185       | 6002         | 002         | TMA (STATIONARY)<br>DOLLARS<br>and<br>CENTS                            | DAY  | 46.000               | 8                   |

# **CERTIFICATION OF INTEREST IN OTHER BID PROPOSALS FOR THIS WORK**

By signing this proposal, the bidding firm and the signer certify that the following information, as indicated by checking "Yes" or "No" below, is true, accurate, and complete.

- A. Quotation(s) have been issued in this firm's name to other firm(s) interested in this work for consideration for performing a portion of this work.

\_\_\_\_\_ YES

\_\_\_\_\_ NO

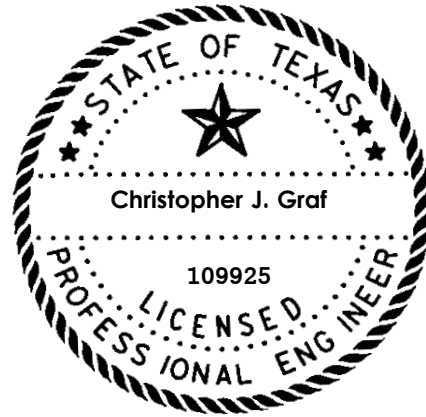
- B. If this proposal is the low bid, the bidder agrees to provide the following information prior to award of the contract.

1. Identify firms which bid as a prime contractor and from which the bidder received quotations for work on this project.
2. Identify all the firms which bid as a prime contractor to which the bidder gave quotations for work on this project.

# ENGINEER SEAL

Control 6400-73-001  
Project RMC - 640073001  
Highway US0067  
County COMANCHE

The enclosed Texas Department of Transportation Specifications, Special Specifications, Special Provisions, General Notes and Specification Data in this document have been selected by me, or under my responsible supervision as being applicable to this project. Alteration of a sealed document without proper notification to the responsible engineer is an offense under the Texas Engineering Practice Act.



The seal appearing on this document was authorized by  
*Christopher J. Graf, P.E.*  
DECEMBER 07, 2022

**Project Number:** RMC-640073001

**County:** COMANCHE

**Control:** 6400-73-001

**Highway:** US 67

**GENERAL NOTES**

TEST TO BE IN ACCORDANCE WITH  
TEXAS DEPARTMENT OF TRANSPORTATION  
STANDARD TEST METHODS.

Asphalt Surface Areas-SY

| Item | Description                       | Course               | Roadway   |
|------|-----------------------------------|----------------------|-----------|
| 3077 | SP MIXES SP-C SAC-B PG 76/22      | 1 <sup>st</sup> Lift | 24,060 SY |
| 354  | PLAN & TEXT ASPH CONC PAV (0"-2") | 1 <sup>st</sup> Lift | 24,060 SY |

Basis of Estimate

| Item | Description                  | Course               | Rate       | SY     | Quantity   |
|------|------------------------------|----------------------|------------|--------|------------|
| 3077 | SP MIXES SP-C SAC-B PG 76/22 | 1 <sup>st</sup> Lift | 230LBS/SY  | 24,060 | 2,767 TONS |
| 3084 | BONDING COURSE               | Tack                 | 0.14GAL/SY | 24,060 | 3,368 GAL  |

**ENVIROMENTAL**

No hazardous chemicals, petroleum products, or concrete washouts will be allowed to be stored in the Department's R.O.W.

-----

**ITEM 2 INSTRUCTIONS TO BIDDERS**

Contractor questions on this project are to be emailed to the following individual(s):

| <u>Name</u>               | <u>Email Address</u>   |
|---------------------------|--|
| Christopher J. Graf, P.E. | <a href="mailto:chris.graf@txdot.gov">chris.graf@txdot.gov</a>             |
| Blake Stenbridge, P.E.    | <a href="mailto:blake.stenbridge@txdot.gov">blake.stenbridge@txdot.gov</a> |

Contractor questions will be accepted through email by the above individuals.

All contractor questions will be reviewed by the Engineer. Once a response is developed, it will be posted to TxDOT's Public FTP at the following Address:

<https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting Responses/>

All questions submitted that generate a response will be posted through this site. The site is organized by District, Project Type (Construction or Maintenance), Letting Date, CCSJ/Project Name.

-----



**Project Number:** RMC-640073001

**County:** COMANCHE

**Control:** 6400-73-001

**Highway:** US 67

## **ITEM 5 CONTROL OF WORK**

The responsibility for the construction surveying on this contract will be in accordance with Section 5.9.1. "Method C".

## **ITEM 7 LEGAL RELATIONS AND RESPONSIBILITIES**

No significant traffic generator events identified.

## **ITEM 351 FLEXIBLE PAVEMENT STRUCTURE REPAIR**

The Contractor will mark locations of flexible pavement repair for approval by the Engineer before starting work on the repair areas.

## **ITEM 354 PLANING AND TEXTURING PAVEMENT**

The planned asphaltic material will be stockpiled at the following locations:

SH 6: On SH 6 just north of Lake Cisco Dam (32°26'59.00"N, 98°58'50.08"W)

FM 3101: Spur 490 south of IH 20 (32°22'22.43"N, 98°53'13.34"W)

US67 & FM 2247: Comanche County Maintenance Yard (31°54'32.46"N, 98°35'54.31"W)

SH 16: CR 235 at SH 16 (31°50'05.63"N, 98°33'40.92"W)

SH 36 South: Comanche County Maintenance Yard (31°54'32.46"N, 98°35'54.31"W)

## **ITEM 502 BARRICADES, SIGNS, AND TRAFFIC HANDLING**

A Contractor Force Account "Safety Contingency" will be established for this project, is intended to be utilized for work zone enhancements, to improve the effectiveness of the Traffic Control Plan, that could not be foreseen in the project planning and design stage. These enhancements will be mutually agreed upon by the Engineer and the Contractor's Responsible Person based on weekly or more frequent traffic management reviews on the project. The Engineer may choose to use existing bid items if it does not slow the implementation of enhancement.

All equipment operated by the Contractor on or within thirty feet (30') of the roadway will have a functioning flashing beacon mounted on it.

All devices shown on the TCP Standards are required and considered subsidiary to Item 502 unless specifically outlined elsewhere in the plans.

All signs will be constructed in accordance with the details shown in the current Standard Highway Sign Designs for Texas manual.

**Project Number:** RMC-640073001

**County:** COMANCHE

**Control:** 6400-73-001

**Highway:** US 67

### **ITEM 506 TEMPORARY EROSION, SEDIMENTATION, AND ENVIRONMENTAL CONTROLS**

Stockpile sites may be cleared of cover vegetation, but the vegetation root system will not be destroyed.

The SW3P for this project shall consist of using Contractor Force Account or Agreed Unit Price if erosion control is deemed necessary and shall be directed by the Engineer.

### **ITEM 662 WORK ZONE PAVEMENT MARKINGS**

Work zone pavement markings will be placed as directed by the Engineer.

Removable work zone pavement markings will be tabs unless otherwise approved by the Engineer.

Temporary tabs will be placed in accordance with WZ (STPM) standard. TxDOT will place final pavement markings.

### **ITEM 3077 SUPERPAVE MIXES**

Use aggregate that meets the SAC requirement of Class B.

Use Ty-C mixture with PG Binder 76-22.

Mixture shall be produced and placed under Item 3077.4.9.4 "Exempt Production."

Binder substitution is not allowed.

RAP and RAS will not be allowed.

Mix to be placed in one lift.

The use of Warm Mix Asphalt (WMA) is required if the haul distance from the Hotmix Plant to the Project is greater than 50 miles.

### **ITEM 3084 BONDING COURSE**

Rates will be adjusted in the field based on exposed surface as directed by the Engineer.

### **ITEM 6185 TRUCK MOUNTED ATTENUATOR (TMA) AND TRAILER ATTENUATOR (TA)**

**TMA's needed will be calculated by the day.**

CONTROL : 6400-73-001  
PROJECT : RMC - 640073001  
HIGHWAY : US0067  
COUNTY : COMANCHE

TEXAS DEPARTMENT OF TRANSPORTATION

**GOVERNING SPECIFICATIONS AND SPECIAL PROVISIONS**

ALL SPECIFICATIONS AND SPECIAL PROVISIONS APPLICABLE TO THIS PROJECT ARE IDENTIFIED AS FOLLOWS:

STANDARD SPECIFICATIONS: ADOPTED BY THE TEXAS DEPARTMENT OF  
----- TRANSPORTATION NOVEMBER 1, 2014.  
STANDARD SPECIFICATIONS ARE INCORPORATED  
INTO THE CONTRACT BY REFERENCE.

ITEMS 1 TO 9 INCL., GENERAL REQUIREMENTS AND COVENANTS  
ITEM 354 PLANING AND TEXTURING PAVEMENT <506>  
ITEM 500 MOBILIZATION  
ITEM 502 BARRICADES, SIGNS, AND TRAFFIC HANDLING  
ITEM 662 WORK ZONE PAVEMENT MARKINGS (666)(668)(672)(677)

SPECIAL PROVISIONS: SPECIAL PROVISIONS WILL GOVERN AND TAKE  
----- PRECEDENCE OVER THE SPECIFICATIONS ENUMERATED  
HEREON WHEREVER IN CONFLICT THEREWITH.

SPECIAL PROVISION "NONDISCRIMINATION" (000---002)  
SPECIAL PROVISION "CERTIFICATE OF INTERESTED PARTIES (FORM 1295)"  
(000--1019)  
SPECIAL PROVISION "SCHEDULE OF LIQUIDATED DAMAGES" (000--1243)  
SPECIAL PROVISION "NOTICE OF CONTRACTOR PERFORMANCE EVALUATIONS"  
(000---659)  
SPECIAL PROVISIONS TO ITEM 2 (002---011)(002---013)  
SPECIAL PROVISIONS TO ITEM 3 (003---011)(003---013)  
SPECIAL PROVISIONS TO ITEM 5 (005---002)(005---003)  
SPECIAL PROVISIONS TO ITEM 6 (006---001)(006---012)  
SPECIAL PROVISIONS TO ITEM 7 (007---004)(007---010)(007---011)  
SPECIAL PROVISIONS TO ITEM 8 (008---030)(008---033)  
SPECIAL PROVISIONS TO ITEM 9 (009---010)(009---011)  
SPECIAL PROVISION TO ITEM 300 (300---020)  
SPECIAL PROVISION TO ITEM 316 (316---002)  
SPECIAL PROVISION TO ITEM 342 (342---005)  
SPECIAL PROVISION TO ITEM 344 (344---005)  
SPECIAL PROVISION TO ITEM 348 (348---004)

SPECIAL PROVISION TO ITEM 502 (502---008)  
SPECIAL PROVISION TO ITEM 506 (506---002)  
SPECIAL PROVISION TO ITEM 520 (520---002)  
SPECIAL PROVISION TO ITEM 666 (666---007)  
SPECIAL PROVISION TO SPECIAL SPECIFICATION ITEM 6185 (6185--002)

SPECIAL SPECIFICATIONS:

-----

ITEM 3002 SPRAY APPLIED UNDERSEAL MEMBRANE  
ITEM 3077 SUPERPAVE MIXTURES <300><301><316><320><342><344><348>  
<506><520><3079><3081><3082><3096>  
ITEM 3079 PERMEABLE FRICTION COURSE (PFC)  
ITEM 3081 THIN OVERLAY MIXTURES (TOM)  
ITEM 3082 THIN BONDED FRICTION COURSES  
ITEM 3084 BONDING COURSE <300><506><3002><3096>  
ITEM 3096 ASPHALTS, OILS, AND EMULSIONS <506>  
ITEM 6185 TRUCK MOUNTED ATTENUATOR (TMA) AND TRAILER ATTENUATOR (TA)

GENERAL: THE ABOVE-LISTED SPECIFICATION ITEMS ARE THOSE UNDER WHICH  
----- PAYMENT IS TO BE MADE. THESE, TOGETHER WITH SUCH OTHER  
PERTINENT ITEMS, IF ANY, AS MAY BE REFERRED TO IN THE ABOVE-  
LISTED SPECIFICATION ITEMS, AND INCLUDING THE SPECIAL  
PROVISIONS LISTED ABOVE, CONSTITUTE THE COMPLETE SPECIFI-  
CATIONS FOR THIS PROJECT.

## **CHILD SUPPORT STATEMENT**

**Under Section 231.006, Family Code, the vendor or applicant certifies that the individual or business entity named in this contract, bid, or application is not ineligible to receive the specified grant, loan, or payment and acknowledges that this contract may be terminated and payment may be withheld if this certification is inaccurate.**

## CONFLICT OF INTEREST CERTIFICATION

Pursuant to Texas Government Code Section 2261.252(b), the Department is prohibited from entering into contracts in which Department officers and employees have a financial interest.

By signing the Contract, the Contractor certifies that it is not prohibited from entering into a Contract with the Department as a result of a financial interest as defined under Texas Government Code Section 2261.252(b), and that it will exercise reasonable care and diligence to prevent any actions or conditions that could result in a conflict of interest with the Department.

The Contractor also certifies that none of the following individuals, nor any of their family members within the second degree of affinity or consanguinity, owns 1% or more interest or has a financial interest as defined under Texas Government Code Section 2261.252(b) in the Contractor:

- Any member of the Texas Transportation Commission; and
- The Department's Executive Director, General Counsel, Chief of Procurement and Field Support Operations, Director of Procurement, and Director of Contract Services.

Violation of this certification may result in action by the Department.

## E-VERIFY CERTIFICATION

Pursuant to Texas Transportation Code §223.051, all TxDOT contracts for construction, maintenance, or improvement of a highway must include a provision requiring Contractors and subcontractors to use the U.S. Department of Homeland Security's E-Verify system to determine employment eligibility. By signing the contract, the Contractor certifies that prior to the award of the Contract:

- the Contractor has registered with and will, to the extent permitted by law, utilize the United States Department of Homeland Security's E-Verify system during the term of the Contract to determine the eligibility of all persons hired to perform duties within Texas during the term of the agreement; and
- the Contractor will require that all subcontractors also register with and, to the extent permitted by law, utilize the United States Department of Homeland Security's E-Verify system during the term of the subcontract to determine the eligibility of all persons hired to perform duties within Texas during the term of the agreement.

Violation of this requirement constitutes a material breach of the Contract, subjects a subcontractor to removal from the Contract, and subjects the Contractor or subcontractors to possible sanctions in accordance with Title 43, Texas Administrative Code, Chapter 10, Subchapter F, "Sanctions and Suspension for Ethical Violations by Entities Doing Business with the Department."

## Certification Regarding Disclosure of Public Information

Pursuant to Subchapter J, Chapter 552, Texas Government Code, contractors executing a contract with a governmental body that results in the expenditure of at least \$1 million in public funds must:

- 1) preserve all contracting information\* as provided by the records retention requirements applicable to Texas Department of Transportation (TxDOT) for the duration of the contract,
- 2) on request of TxDOT, promptly provide any contracting information related to the contract that is in the custody or possession of the entity, and
- 3) on completion of the contract, either:
  - A. provide, at no cost to TxDOT, all contracting information related to the contract that is in the custody or possession of the entity, or
  - B. preserve the contracting information related to the contract as provided by the records retention requirements applicable to TxDOT

The requirements of Subchapter J, Chapter 552, Government Code, may apply to this contract, and the contractor or vendor agrees that the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter.

By entering into Contract, the Contractor agrees to:

- provide, or make available, to TxDOT and any authorized governmental investigating or auditing agency all records, including electronic and payment records related to the contract, for the same period provided by the records retention schedule applicable to TxDOT, and
- ensure that all subcontracts include a clause requiring the same.

\* As defined in Government Code §552.003, “Contracting information” means the following information maintained by a governmental body or sent between a governmental body and a vendor, contractor, potential vendor, or potential contractor:

- 1) information in a voucher or contract relating to the receipt or expenditure of public funds by a governmental body;
- 2) solicitation or bid documents relating to a contract with a governmental body;
- 3) communications sent between a governmental body and a vendor, contractor, potential vendor, or potential contractor during the solicitation, evaluation, or negotiation of a contract;
- 4) documents, including bid tabulations, showing the criteria by which a governmental body evaluates each vendor, contractor, potential vendor, or potential contractor responding to a solicitation and, if applicable, an explanation of why the vendor or contractor was selected; and
- 5) communications and other information sent between a governmental body and a vendor or contractor related to the performance of a final contract with the governmental body or work performed on behalf of the governmental body.



## CERTIFICATION TO NOT BOYCOTT ISRAEL

Pursuant to Texas Government Code §2271.002, the Department must include a provision requiring a written verification affirming that the Contractor does not boycott Israel, as defined in Government Code §808.001, and will not boycott Israel during the term of the contract. This provision applies to a contract that:

- 1) is with a Contractor that is not a sole proprietorship,
- 2) is with a Contractor with 10 or more full-time employees, and
- 3) has a value of \$100,000 or more.

By signing the contract, the Contractor certifies that it does not boycott Israel and will not boycott Israel during the term of this contract. "Boycott" 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.

Violation of this certification may result in action by the Department.

## CERTIFICATION TO NOT BOYCOTT ENERGY COMPANIES

Pursuant to Texas Government Code §2274.002, the Department must include a provision requiring a written verification affirming that the Contractor does not boycott energy companies, as defined in Government Code §809.001, and will not boycott energy companies during the term of the contract. This provision applies to a contract that:

- 1) is with a Contractor that is not a sole proprietorship,
- 2) is with a Contractor with 10 or more full-time employees, and
- 3) has a value of \$100,000 or more.

By signing the contract, the Contractor certifies that it does not boycott energy companies and will not boycott energy companies during the term of this contract. "Boycott" means taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with a company because the company: (1) engages in the exploration, production, utilization, transportation, sale, or manufacturing of fossil fuel-based energy and does not commit or pledge to meet environmental standards beyond applicable federal and state law; or (2) does business with a company described by (1).

Violation of this certification may result in action by the Department.

## CERTIFICATION TO NOT DISCRIMINATE AGAINST FIREARM ENTITIES OR FIREARM TRADE ASSOCIATIONS

Pursuant to Texas Government Code §2274.002, the Department must include a provision requiring a written verification affirming that the Contractor:

- 1) does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association, as defined in Government Code §2274.001, and
- 2) will not discriminate against a firearm entity or firearm trade association during the term of the contract.

This provision applies to a contract that:

- 1) is with a Contractor that is not a sole proprietorship,
- 2) is with a Contractor with 10 or more full-time employees, and
- 3) has a value of \$100,000 or more.

By signing the contract, the Contractor certifies that it does not discriminate against a firearm entity or firearm trade association as described and will not do so during the term of this contract. "Discriminate against a firearm entity or firearm trade association" means, with respect to the entity or association, to: (1) refuse to engage in the trade of any goods or services with the entity or association based solely on its status as a firearm entity or firearm trade association; (2) refrain from continuing an existing business relationship with the entity or association based solely on its status as a firearm entity or firearm trade association; or (3) terminate an existing business relationship with the entity or association based solely on its status as a firearm entity or firearm trade association. "Discriminate against a firearm entity or firearm trade association" does not include: (1) the established policies of a merchant, retail seller, or platform that restrict or prohibit the listing or selling of ammunition, firearms, or firearm accessories; (2) a company's refusal to engage in the trade of any goods or services, decision to refrain from continuing an existing business relationship, or decision to terminate an existing business relationship to comply with federal, state, or local law, policy, or regulations or a directive by a regulatory agency, or for any traditional business reason that is specific to the customer or potential customer and not based solely on an entity's or association's status as a firearm entity or firearm trade association.

Violation of this certification may result in action by the Department.

# Special Provision to Item 000

## Nondiscrimination



### 1. DESCRIPTION

All recipients of federal financial assistance are required to comply with various nondiscrimination laws including Title VI of the Civil Rights Act of 1964, as amended, (Title VI). Title VI forbids discrimination against anyone in the United States on the grounds of race, color, or national origin by any agency receiving federal funds.

Texas Department of Transportation, as a recipient of Federal financial assistance, and under Title VI and related statutes, ensures that no person shall on the grounds of race, religion (where the primary objective of the financial assistance is to provide employment per 42 U.S.C. § 2000d-3), color, national origin, sex, age or disability be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any Department programs or activities.

### 2. DEFINITION OF TERMS

Where the term “contractor” appears in the following six nondiscrimination clauses, the term “contractor” is understood to include all parties to contracts or agreements with the Texas Department of Transportation.

### 3. NONDISCRIMINATION PROVISIONS

During the performance of this contract, the contractor agrees as follows:

- 3.1. **Compliance with Regulations.** The Contractor shall comply with the Regulations relative to nondiscrimination in Federally-assisted programs of the Department of Transportation (hereinafter, “DOT”) Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.
- 3.2. **Nondiscrimination.** The contractor, with regard to the work performed by it during the contract, shall 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 shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.
- 3.3. **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 shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.
- 3.4. **Information and Reports:** The contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Texas Department of Transportation to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information the contractor shall so certify to the Recipient, or the Texas Department of Transportation as appropriate, and shall set forth what efforts it has made to obtain the information.

- 3.5. **Sanctions for Noncompliance.** In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the Recipient shall impose such contract sanctions as it or the Texas Department of Transportation may determine to be appropriate, including, but not limited to:
- withholding of payments to the contractor under the contract until the contractor complies, and/or
  - cancellation, termination or suspension of the contract, in whole or in part.
- 3.6. **Incorporation of Provisions.** The contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the Recipient or the Texas Department of Transportation may direct as a means of enforcing such provisions including sanctions for non-compliance: Provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the Recipient to enter into such litigation to protect the interests of the Recipient, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

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## Special Provision 000

### Certificate of Interested Parties (Form 1295)

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Submit a notarized Form 1295, "Certificate of Interested Parties," in the following instances:

- at Contract execution for Contracts awarded by the Commission;
- at Contract execution for Contracts awarded by the District Engineer or Chief Engineer with an award amount of \$1,000,000 or more; at any time an existing Contract awarded by the District Engineer or Chief Engineer increases in value to \$1,000,000 or more due to changes in the Contract; at any time there is an increase of \$1,000,000 or more to an existing Contract (change orders, extensions, and renewals); or
- at any time there is a change to the information in Form 1295, when the form was filed for an existing Contract.

Form 1295 and instructions on completing and filing the form are available on the Texas Ethics Commission website.

# Special Provision 000

## Important Notice to Contractors



| For Dollar Amount of Original Contract |                  | Dollar Amount of Daily Contract Administration Liquidated Damages per Working Day |
|--|------------------|---|
| From More Than                         | To and including |   |
| 0                                      | 1,000,000        | 618   |
| 1,000,000                              | 3,000,000        | 832   |
| 3,000,000                              | 5,000,000        | 940   |
| 5,000,000                              | 15,000,000       | 1317  |
| 15,000,000                             | 25,000,000       | 1718  |
| 25,000,000                             | 50,000,000       | 2411  |
| 50,000,000                             | Over 50,000,000  | 4265  |

In addition to the amount shown in Table 1, the Liquidated Damages will be increased by the amount shown in Item 8 of the General Notes for Road User Cost (RUC), when applicable.

# Special Provision 000

## Notice of Contractor Performance Evaluations



### 1. GENERAL

In accordance with Texas Transportation Code §223.012, the Engineer will evaluate Contractor performance based on quality, safety, and timeliness of the project.

### 2. DEFINITIONS

- 2.1. **Project Recovery Plan (PRP)**—a formal, enforceable plan developed by the Contractor, in consultation with the District, that documents the cause of noted quality, safety, and timeliness issues and specifies how the Contractor proposes to correct project-specific performance deficiencies.

In accordance with Title 43, Texas Administrative Code (TAC), §9.23, the District will request a PRP if the Contractor's performance on a project is below the Department's acceptable standards and will monitor the Contractor's compliance with the established plan.

- 2.2. **Corrective Action Plan (CAP)**—a formal, enforceable plan developed by the Contractor, and proposed for adoption by the Construction or Maintenance Division, that documents the cause of noted quality, safety, and timeliness issues and specifies how the Contractor proposes to correct statewide performance deficiencies.

In accordance with 43 TAC §9.23, the Division will request a CAP if the average of the Contractor's statewide final evaluation scores falls below the Department's acceptable standards for the review period and will monitor the Contractor's compliance with the established plan.

### 3. CONTRACTOR EVALUATIONS

In accordance with Title 43, Texas Administrative Code (TAC) §9.23, the Engineer will schedule evaluations at the following intervals, at minimum:

- Interim evaluations—at or within 30 days after the anniversary of the notice to proceed, for Contracts extending beyond 1 yr., and
- Final evaluation—upon project closeout.

In case of a takeover agreement, neither the Surety nor its performing Contractor will be evaluated.

In addition to regularly scheduled evaluations, the Engineer may schedule an interim evaluation at any time to formally communicate issues with quality, safety, or timeliness. Upon request, work with the Engineer to develop a PRP to document expectations for correcting deficiencies.

Comply with the PRP as directed. Failure to comply with the PRP may result in additional remedial actions available to the Engineer under Item 5, "Control of the Work." Failure to meet a PRP to the Engineer's satisfaction may result in immediate referral to the Performance Review Committee for consideration of further action against the Contractor.

The Engineer will consider and document any events outside the Contractor's control that contributed to the failure to meet performance standards or comply with a PRP, including consideration of sufficient time.

Follow the escalation ladder if there is a disagreement regarding an evaluation or disposition of a PRP. The Contractor may submit additional documentation pertaining to the dispute. The District Engineer's decision



on a Contractor's evaluation score and recommendation of action required in a PRP or follow up for non-compliance is final.

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#### **4. DIVISION OVERSIGHT**

Upon request of the Construction or Maintenance Division, develop and submit for Division approval a proposed CAP to document expectations for correcting deficiencies in the performance of projects statewide.

Comply with the CAP as directed. The CAP may be modified at any time up to completion or resolution after written approval of the premise of change from the Division. Failure to meet an adopted or revised adopted CAP to the Division's satisfaction within 120 days will result in immediate referral to the Performance Review Committee for consideration of further action against the Contractor.

The Division will consider and document any events outside the Contractor's control that contributed to the failure to meet performance standards or comply with a CAP, including consideration of sufficient time and associated costs as appropriate.

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#### **5. PERFORMANCE REVIEW COMMITTEE**

The Performance Review Committee, in accordance with 43 TAC §9.24, will review at minimum all final evaluations, history of compliance with PRPs, any adopted CAPs including agreed modifications, any information about events outside a Contractor's control contributing to the Contractor's performance, and any documentation submitted by the Contractor and may recommend one or more of the following actions:

- take no action,
- reduce the Contractor's bidding capacity,
- prohibit the Contractor from bidding on one or more projects,
- immediately suspend the Contractor from bidding for a specified period of time, by reducing the Contractor's bidding capacity to zero, or
- prohibit the Contractor from being awarded a Contract on which they are the apparent low bidder.

The Deputy Executive Director will determine any further action against the Contractor.

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#### **6. APPEALS PROCESS**

In accordance with 43 TAC §9.25, the Contractor may appeal remedial actions determined by the Deputy Executive Director.

## Special Provision to Item 2

### Instructions to Bidders



Item 2, "Instructions to Bidders," of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 2.3., "Issuing Proposal Forms,"** is supplemented by the following:

- the Bidder or affiliate of the Bidder that was originally determined as the apparent low Bidder on a project, but was deemed nonresponsive for failure to register or participate in the Department of Homeland Security's (DHS) E-Verify system as specified in Article 2.15., "Department of Homeland Security (DHS) E-Verify System," is prohibited from rebidding that specific project.

**Article 2.7., "Nonresponsive Bid,"** is supplemented by the following:

- the Bidder failed to participate in the Department of Homeland Security's (DHS) as specified in Article 2.15., "Department of Homeland Security (DHS) E-Verify System."

**Article 2.15., "Department of Homeland Security (DHS) E-Verify System,"** is added.

The Department will not award a Contract to a Contractor that is not registered in the DHS E-Verify system. Remain active in E-Verify throughout the life of the contract. In addition, in accordance with paragraph six of Article 8.2, "Subcontracting," include this requirement in all subcontracts and require that subcontractors remain active in E-Verify until their work is completed.

If the apparent low Bidder does not appear on the DHS E-Verify system prior to award, the Department will notify the Contractor that they must submit documentation showing that they are compliant within 5-business days after the date the notification was sent. A Contractor who fails to comply or respond within the deadline will be declared non-responsive and the Department will execute the proposal guaranty. The proposal guaranty will become the property of the State, not as a penalty, but as liquidated damages. The Bidder forfeiting the proposal guaranty will not be considered in future proposals for the same work unless there has been a substantial change in the scope of the work.

The Department may recommend that the Commission:

- reject all bids, or
- award the Contract to the new apparent low Bidder, if the Department is able to verify the Bidder's participation in the DHS E-verify system. For the Bidder who is not registered in E-Verify, the Department will allow for one business day after notification to provide proof of registration.

If the Department is unable to verify the new apparent low Bidder's participation in the DHS E-Verify system within one calendar day:

- the new apparent low Bidder will not be deemed nonresponsive,
- the new apparent low Bidder's guaranty will not be forfeited,
- the Department will reject all bids, and
- the new apparent low Bidder will remain eligible to receive future proposals for the same project.

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## Special Provision to Item 2

### Instructions to Bidders

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Item 2, "Instructions to Bidders" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 3., "Issuing Proposal Forms,"** is supplemented by the following:

The Electronic State Business Daily (ESBD), the Integrated Contractor Exchange (iCX) system, and the project proposal are the official sources of advertisement and bidding information for the State and Local Lettings. Bidders should bid the project using the information found therein, including any addenda. These sources take precedence over information from other sources, including TxDOT webpages, which are unofficial and intended for informational purposes only.

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## Special Provision to Item 3 Award and Execution Contract

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Item 3, Award and Execution of Contract," of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Section 4.3, "Insurance."** The first sentence is voided and replaced by the following:

For construction and building Contracts, submit a certificate of insurance showing coverages in accordance with Contract requirements. For routine maintenance Contracts, refer to Article 8, "Beginning of Work."

**Article 8, "Beginning of Work."** The first sentence is supplemented by the following:

For a routine maintenance Contract, do not begin work until a certificate of insurance showing coverages in accordance with the Contract requirements is provided and accepted.

## Special Provision to Item 3

### Award and Execution of Contract



Item 3, "Award and Execution of Contract" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Section 4.3 "Insurance" is being amended by the following:**

**Table 2**  
**Insurance Requirements**

| <b>Type of Insurance</b>  | <b>Amount of Coverage</b>                         |
|---|---|
| Commercial General Liability Insurance  | Not Less Than:<br>\$600,000 each occurrence       |
| Business Automobile Policy  | Not Less Than:<br>\$600,000 combined single limit |
| Workers' Compensation   | Not Less Than:<br>Statutory                       |
| All Risk Builder's Risk Insurance<br>(For building-facilities contracts only) | 100% of Contract Price                            |

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## Special Provision to Item 5

### Control of the Work

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Item 5, "Control of the Work," of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 5.1, "Authority of Engineer,"** is voided and replaced by the following.

The Engineer has the authority to observe, test, inspect, approve, and accept the work. The Engineer decides all questions about the quality and acceptability of materials, work performed, work progress, Contract interpretations, and acceptable Contract fulfillment. The Engineer has the authority to enforce and make effective these decisions.

The Engineer acts as a referee in all questions arising under the terms of the Contract. The Engineer's decisions will be final and binding.

The Engineer will pursue and document actions against the Contractor as warranted to address Contract performance issues. Contract remedies include, but are not limited to, the following:

- conducting interim performance evaluations requiring a Project Recovery Plan, in accordance with Title 43, Texas Administrative Code (TAC) §9.23,
- requiring the Contractor to remove and replace defective work, or reducing payment for defective work,
- removing an individual from the project,
- suspending the work without suspending working day charges,
- assessing standard liquidated damages to recover the Department's administrative costs, including additional project-specific liquidated damages when specified in the Contract in accordance with 43 TAC §9.22,
- withholding estimates,
- declaring the Contractor to be in default of the Contract, and
- in case of a Contractor's failure to meet a Project Recovery Plan, referring the issue directly to the Performance Review Committee for consideration of further action against the Contractor in accordance with 43 TAC §9.24.

The Engineer will consider and document any events outside the Contractor's control that contributed to the failure to meet performance standards, including consideration of sufficient time.

Follow the issue escalation ladder if there is disagreement regarding the application of Contract remedies.

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## Special Provision to Item 5

### Control of the Work

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Item 5, "Control of the Work" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 5.4, "Coordination of Plans, Specifications, and Special Provisions," the last sentence of the last paragraph is replaced by the following:**

Failure to promptly notify the Engineer will constitute a waiver of all contract claims against the Department for misunderstandings or ambiguities that result from the errors, omissions, or discrepancies.

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## Special Provision to Item 6

### Control of Materials

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For this project, Item 6, "Control of Materials," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

**Article 4., "Sampling, Testing, and Inspection,"** is supplemented by the following:

Meet with the Engineer and choose either the Department or a Department-selected Commercial Lab (CL) for conducting the subset of project-level sampling and testing shown in Table 1, "Select Guide Schedule Sampling and Testing." Selection may be made on a test by test basis. CLs will meet the testing turnaround times shown (includes test time and time for travel/sampling and reporting) and in all cases issue test reports as soon as possible.

If the Contractor chooses a Department-selected CL for any Table 1 sampling and testing:

- notify the Engineer, District Lab, and the CL of project scheduling that may require CL testing;
- provide the Engineer, District Lab, and CL at least 24 hours' notice by phone and e-mail;
- reimburse the Department for CL Table 1 testing using the contract fee schedule for the CL (including mileage and travel/standby time) at the minimum guide schedule testing frequencies;
- reimburse the Department for CL Table 1 testing above the minimum guide schedule frequencies for retesting when minimum frequency testing results in failures to meet specification limits;
- agree with the Engineer and CL upon a policy regarding notification for testing services;
- give any cancellation notice to the Engineer, District Lab, and CL by phone and e-mail;
- reimburse the Department a \$150 cancellation fee to cover technician time and mileage charges for previously scheduled work cancelled without adequate notice, which resulted in mobilization of technician and/or equipment by the CL; and
- all CL charges will be reimbursed to the Department by a deduction from the Contractor's monthly pay estimate.

If the CL does not meet the Table 1 turnaround times, testing charge to the Contractor will be reduced by 50% for the first late day and an additional 5% for each succeeding late day.

Approved CL project testing above the minimum testing frequencies in the Guide Schedule of Sampling and Testing, and not as the result of failing tests, will be paid by the Department.

Other project-level Guide Schedule sampling and testing not shown on Table 1 will be the responsibility of the Department.



**Table 1**  
**Select Guide Schedule Sampling and Testing (Note 1)**

| <b>TxDOT Test</b>                                   | <b>Test Description</b>   | <b>Turn-Around Time<br/>(Calendar days)</b> |
|---|---|---|
| <b>SOILS/BASE</b>                                   |   |   |
| Tex-101-E   | Preparation of Soil and Flexible Base Materials for Testing (included in other tests)   |   |
| Tex-104-E   | Liquid Limit of Soils (included in 106-E)   |   |
| Tex-105-E   | Plastic Limit of Soils (included in 106-E)  |   |
| Tex-106-E   | Calculating the Plasticity Index of Soils   | 7   |
| Tex-110-E   | Particle Size Analysis of Soils   | 6   |
| Tex-113-E   | Moisture-Density Relationship of Base Materials   | 7   |
| Tex-114-E   | Moisture-Density Relationship of Subgrade and Embankment Soil   | 7   |
| Tex-115-E   | Field Method for In-Place Density of Soils and Base Materials   | 2   |
| Tex-116-E   | Ball Mill Method for the Disintegration of Flexible Base Material   | 5   |
| Tex-117-E, Part II                                  | Triaxial Compression Tests For Disturbed Soils and Base Materials (Part II)   | 6   |
| Tex-113-E<br>w/ Tex-117-E                           | Moisture-Density Relationship of Base Materials <b>with</b> Triaxial Compression Tests For Disturbed Soils and Base Materials (Part II)   | 10  |
| Tex-140-E   | Measuring Thickness of Pavement Layer   | 2   |
| Tex-145-E   | Determining Sulfate Content in Soils - Colorimetric Method  | 4   |
| <b>HOT MIX ASPHALT</b>                              |   |   |
| Tex-200-F   | Sieve Analysis of Fine and Coarse Aggregate (dry, from ignition oven with known correction factors)   | 1<br>(Note 2)                               |
| Tex-203-F   | Sand Equivalent Test  | 3   |
| Tex-206-F,<br>w/ Tex-207-F, Part I,<br>w/ Tex-227-F | <b>(Lab-Molded Density of Production Mixture – Texas Gyrotory)</b><br>Method of Compacting Test Specimens of Bituminous Mixtures <b>with</b> Density of Compacted Bituminous Mixtures, Part I - Bulk Specific Gravity of Compacted Bituminous Mixtures, <b>with</b> Theoretical Maximum Specific Gravity of Bituminous Mixtures   | 1<br>(Note 2)                               |
| Tex-207-F, Part I<br>&/or Part VI                   | <b>(In-Place Air Voids of Roadway Cores)</b><br>Density of Compacted Bituminous Mixtures, Part I- Bulk Specific Gravity of Compacted Bituminous Mixtures <b>&amp;/or</b> Part VI - Bulk Specific Gravity of Compacted Bituminous Mixtures Using the Vacuum Method   | 1<br>(Note 2)                               |
| Tex-207-F, Part V                                   | Density of Compacted Bituminous Mixtures, Part V- Determining Mat Segregation using a Density-Testing Gauge   | 3   |
| Tex-207-F, Part VII                                 | Density of Compacted Bituminous Mixtures, Part VII - Determining Longitudinal Joint Density using a Density-Testing Gauge   | 4   |
| Tex-212-F   | Moisture Content of Bituminous Mixtures   | 3   |
| Tex-217-F   | Deleterious Material and Decantation Test for Coarse Aggregate  | 4   |
| Tex-221-F   | Sampling Aggregate for Bituminous Mixtures, Surface Treatments, and LRA (included in other tests)   |   |
| Tex-222-F   | Sampling Bituminous Mixtures (included in other tests)  |   |
| Tex-224-F   | Determination of Flakiness Index  | 3   |
| Tex-226-F   | Indirect Tensile Strength Test (production mix)   | 4   |
| Tex-235-F   | Determining Draindown Characteristics in Bituminous Materials   | 3   |
| Tex-236-F<br>(Correction Factors)                   | Asphalt Content from Asphalt Paving Mixtures by the Ignition Method (Determining Correction Factors)  | 4   |
| Tex-236-F   | Asphalt Content from Asphalt Paving Mixtures by the Ignition Method (Production Mixture)  | 1<br>(Note 2)                               |
| Tex-241-F<br>w/ Tex-207-F, Part I,<br>w/ Tex-227-F  | <b>(Lab-Molded Density of Production Mixture – Superpave Gyrotory)</b><br>Superpave Gyrotory Compacting of Specimens of Bituminous Mixtures (production mixture) <b>with</b> Density of Compacted Bituminous Mixtures, Part I- Part I - Bulk Specific Gravity of Compacted Bituminous Mixtures, <b>with</b> Theoretical Maximum Specific Gravity of Bituminous Mixtures | 1<br>(Note 2)                               |
| Tex-242-F   | Hamburg Wheel-Tracking Test (production mix, molded samples)  | 3   |
| Tex-244-F   | Thermal Profile of Hot Mix Asphalt  | 1   |
| Tex-246-F   | Permeability of Water Flow of Hot Mix Asphalt   | 3   |
| Tex-280-F   | Flat and Elongated Particles  | 3   |
| Tex-530-C   | Effect of Water on Bituminous Paving Mixtures (production mix)  | 4   |

| AGGREGATES  |  |    |
|---|--|----|
| Tex-400-A   | Sampling Flexible Base, Stone, Gravel, Sand, and Mineral Aggregates  | 3  |
| Tex-410-A   | Abrasion of Coarse Aggregate Using the Los Angeles Machine           | 5  |
| Tex-411-A   | Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate | 12 |
| Tex-461-A   | Degradation of Coarse Aggregate by Micro-Deval Abrasion              | 5  |
| CHEMICAL  |  |    |
| Tex-612-J   | Acid Insoluble Residue for Fine Aggregate                            | 4  |
| GENERAL   |  |    |
| HMA Production Specialist [TxAPA – Level 1-A] (\$/hr)   |  |    |
| HMA Roadway Specialist [TxAPA – Level 1-B] (\$/hr)  |  |    |
| Technician Travel/Standby Time (\$/hr)  |  |    |
| Per Diem (\$/day – meals and lodging)   |  |    |
| Mileage Rate (\$/mile from closest CL location)   |  |    |
| <p><b>Note 1– Turn-Around Time includes test time and time for travel/sampling and reporting.</b></p> <p><b>Note 2 – These tests require turn-around times meeting the governing specifications. Provide test results within the stated turn-around time.</b></p> <p><b>CL is allowed one additional day to provide the signed and sealed report.</b></p> |  |    |

# Special Provision to Item 6

## Control of Materials



Item 6, "Control of Materials" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 6.10., "Hazardous Materials,"** is voided and replaced by the following:

Comply with the requirements of Article 7.12., "Responsibility for Hazardous Materials."

Notify the Engineer immediately when a visual observation or odor indicates that materials on sites owned or controlled by the Department may contain hazardous materials. Except as noted herein, the Department is responsible for testing, removing, and disposing of hazardous materials not introduced by the Contractor. The Engineer may suspend work wholly or in part during the testing, removing, or disposing of hazardous materials, except in the case where hazardous materials are introduced by the Contractor.

Use materials that are free of hazardous materials. Notify the Engineer immediately if materials are suspected to contain hazardous materials. If materials delivered to the project by the Contractor are suspected to contain hazardous materials, have an approved commercial laboratory test the materials for the presence of hazardous materials as approved. Remove, remediate, and dispose of any of these materials found to contain hazardous materials. The work required to comply with this section will be at the Contractor's expense if materials are found to contain hazardous materials. Working day charges will not be suspended and extensions of working days will not be granted for activities related to handling hazardous material introduced by the Contractor. If suspected materials are not found to contain hazardous materials, the Department will reimburse the Contractor for hazardous materials testing and will adjust working day charges if the Contractor can show that this work impacted the critical path.

**10.1. Painted Steel Requirements.** Coatings on existing steel contain hazardous materials unless otherwise shown on the plans. Remove paint and dispose of steel coated with paint containing hazardous materials in accordance with the following:

**10.1.1. Removing Paint From Steel** For contracts that are specifically for painting steel, Item 446, "Field Cleaning and Painting Steel" will be included as a pay item. Perform work in accordance with that item.

For projects where paint must be removed to allow for the dismantling of steel or to perform other work, the Department will provide for a separate contractor (third party) to remove paint containing hazardous materials prior to or during the Contract. Remove paint covering existing steel shown not to contain hazardous materials in accordance with Item 446, "Field Cleaning and Painting Steel."

**10.1.2. Removal and Disposal of Painted Steel.** For steel able to be dismantled by unbolting, paint removal will not be performed by the Department. The Department will remove paint, at locations shown on the plans or as agreed, for the Contractor's cutting and dismantling purposes. Utilize Department cleaned locations for dismantling when provided or provide own means of dismantling at other locations.

Painted steel to be retained by the Department will be shown on the plans. For painted steel that contains hazardous materials, dispose of the painted steel at a steel recycling or smelting facility unless otherwise shown on the plans. Maintain and make available to the Engineer invoices and other records obtained from the facility showing the received weight of the steel and the facility name. Dispose of steel that does not contain hazardous material coatings in accordance with federal, state and local regulations.

**10.2. Asbestos Requirements.** The plans will indicate locations or elements where asbestos containing materials (ACM) are known to be present. Where ACM is known to exist or where previously unknown ACM has been found, the Department will arrange for abatement by a separate contractor prior to or during the Contract. Notify the Engineer of proposed dates of demolition or removal of structural elements with ACM at least 60 days before beginning work to allow the Department sufficient time for abatement.

The Department of State Health Services (DSHS), Asbestos Programs Branch, is responsible for administering the requirements of the National Emissions Standards for Hazardous Air Pollutants, 40 CFR Part 61, Subpart M and the Texas Asbestos Health Protection Rules (TAHPR). Based on EPA guidance and regulatory background information, bridges are considered to be a regulated "facility" under NESHAP. Therefore, federal standards for demolition and renovation apply.

The Department is required to notify the DSHS at least 10 working days (by postmarked date) before initiating demolition or renovation of each structure or load bearing member shown on the plans. If the actual demolition or renovation date is changed or delayed, notify the Engineer in writing of the revised dates in sufficient time to allow for the Department's notification to DSHS to be postmarked at least 10 days in advance of the actual work.

Failure to provide the above information may require the temporary suspension of work under Article 8.4., "Temporary Suspension of Work or Working Day Charges," due to reasons under the control of the Contractor. The Department retains the right to determine the actual advance notice needed for the change in date to address post office business days and staff availability.

**10.3. Lead Abatement.** Provide traffic control as shown on the plans, and coordinate and cooperate with the third party and the Department for managing or removing hazardous materials. Work for the traffic control shown on the plans and coordination work will not be paid for directly but will be subsidiary to pertinent Items.

# Special Provision to Item 7

## Legal Relations and Responsibilities



Item 7, "Legal Relations and Responsibilities," of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Section 7.7.2., "Texas Pollutant Discharge Elimination System (TPDES) Permits and Storm Water Pollution Prevention Plans (SWP3)," is voided and replaced by the following:**

**7.2. Texas Pollution Discharge Elimination System (TPDES) Permits and Storm Water Pollution Prevention Plans (SWP3).**

**7.2.1. Projects with less than one acre of soil disturbance including required associated project specific locations (PSL's) per TPDES GP TXR 150000.**

No posting or filing will be required for soil disturbances within the right of way. Adhere to the requirements of the SWP3.

**7.2.2. Projects with one acre but less than five acres of soil disturbance including required associated PSL's per TPDES GP TXR 150000.**

The Department will be considered a primary operator for Operational Control Over Plans and Specifications as defined in TPDES GP TXR 150000 for construction activity in the right of way. The Department will post a small site notice along with other requirements as defined in TPDES GP TXR 150000 as the entity of having operational control over plans and specifications for work shown on the plans in the right of way.

The Contractor will be considered a Primary Operator for Day-to-Day Operational Control as defined in TPDES GP TXR 150000 for construction activity in the right of way. In addition to the Department's actions, the Contractor will post a small site notice along with other requirements as defined in TPDES GP TXR 150000 as the entity of having day-to-day operational control of the work shown on the plans in the right of way. This is in addition to the Contractor being responsible for TPDES GP TXR 150000 requirements for on- right of way and off- right of way PSL's. Adhere to all requirements of the SWP3 as shown on the plans. The Contractor will be responsible for Implement the SWP3 for the project site in accordance with the plans and specifications, TPDES General Permit TXR150000, and as directed.

**7.2.3. Projects with 5 acres or more of soil disturbance including required associated PSL's per TPDES GP TXR 150000.**

The Department will be considered a primary operator for Operational Control Over Plans and Specifications as defined in TPDES GP TXR 150000 for construction activities in the right of way. The Department will post a large site notice, file a notice of intent (NOI), notice of change (NOC), if applicable, and a notice of termination (NOT) along with other requirements per TPDES GP TXR 150000 as the entity having operational control over plans and specifications for work shown on the plans in the right of way.

The Contractor will be considered a primary operator for Day-to-Day Operational Control as defined in TPDES GP TXR 150000 for construction activities in the right of way. In addition to the Department's actions, the Contractor shall file a NOI, NOC, if applicable, and NOT and post a large site notice along with other requirements as the entity of having day-to-day operational control of the work shown on the plans in the right of way. This is in addition to the Contractor

being responsible for TPDES GP TXR 150000 requirements for on- right of way and off- right of way PSL's. Adhere to all requirements of the SWP3 as shown on the plans.

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## Special Provision to Item 7

### Legal Relations and Responsibilities

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Item 7, "Legal Relations and Responsibilities," of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Section 7.2.4., "Public Safety and Convenience."** The first paragraph is deleted and replaced by the following.

Ensure the safety and convenience of the public and property as provided in the Contract and as directed. Keep existing roadways open to traffic or construct and maintain detours and temporary structures for safe public travel. Manage construction to minimize disruption to traffic. Maintain the roadway in a good and passable condition, including proper drainage and provide for ingress and egress to adjacent property.

If the construction of the project requires the closing of a highway, as directed, coordinate the closure with the Engineer and work to ensure all lanes and ramps possible are available during peak traffic periods before, during, and after significant traffic generator events to avoid any adverse economic impact on the municipalities during:

- dates or events as shown on the plans, and
- other dates as directed.

# Special Provision to Item 007

## Legal Relations and Responsibilities



Item 7, "Legal Relations and Responsibilities," of the Standard Specifications is amended with respect to the clauses cited below.

**Section 2.6., "Barricades, Signs, and Traffic Handling,"** the first paragraph is voided and replaced by the following:

- 2.6. **Barricades, Signs, and Traffic Handling.** Comply with the requirements of Item 502 "Barricades, Signs, and Traffic Handling," and as directed. Provide traffic control devices that conform to the details shown on the plans, the TMUTCD, and the Department's Compliant Work Zone Traffic Control Device List maintained by the Traffic Safety Division. When authorized or directed, provide additional signs or traffic control devices not required by the plans.

**Section 2.6.1., "Contractor Responsible Person and Alternative,"** is voided and replaced by the following:

- 2.6.1. **Contractor Responsible Person and Alternative.** Designate in writing, a Contractor's Responsible Person (CRP) and an alternate to be the representative of the Contractor who is responsible for taking or directing corrective measures regarding the traffic control. The CRP or alternate must be accessible by phone 24 hr. per day and able to respond when notified. The CRP and alternate must comply with the requirements of Section 2.6.5., "Training."

**Section 2.6.2, "Flaggers,"** the first paragraph is voided and replaced by the following:

- 2.6.2. **Flaggers.** Designate in writing, a flagger instructor who will serve as a flagging supervisor and is responsible for training and assuring that all flaggers are qualified to perform flagging duties. Certify to the Engineer that all flaggers will be trained and make available upon request a list of flaggers trained to perform flagging duties.

**Section 2.6.5, "Training,"** is voided and replaced by the following:

- 2.6.5. **Training.** Train workers involved with the traffic control using Department-approved training as shown on the "Traffic Control Training" Material Producer List.

Coordinate enrollment, pay associated fees, and successfully complete Department-approved training or Contractor-developed training. Training is valid for the period prescribed by the provider. Except for law enforcement personnel training, refresher training is required every 4 yr. from the date of completion unless otherwise specified by the course provider. The Engineer may require training at a frequency instead of the period prescribed based on the Department's needs. Training and associated fees will not be measured or paid for directly but are considered subsidiary to pertinent Items.

Certify to the Engineer that workers involved in traffic control and other work zone personnel have been trained and make available upon request a copy of the certification of completion to the Engineer. Ensure the following is included in the certification of completion:

- name of provider and course title,
- name of participant,
- date of completion, and
- date of expiration.



Where Contractor-developed training or a Department-approved training course does not produce a certification, maintain a log of attendees. Make the log available upon request. Ensure the log is legible and includes the following:

- printed name and signature of participant,
- name and title of trainer, and
- date of training.

2.6.5.1. **Contractor-developed Training.** Develop and deliver Contractor-developed training meeting the minimum requirements established by the Department. The outline for this training must be submitted to the Engineer for approval at the preconstruction meeting. The CRP or designated alternate may deliver the training instead of the Department-approved training. The work performed and materials furnished to develop and deliver the training will not be measured or paid for directly but will be considered subsidiary to pertinent Items.

2.6.5.1.1. **Flagger Training Minimum Requirements.** A Contractor's certified flagging instructor is permitted to train other flaggers.

2.6.5.1.2. **Optional Contractor-developed Training for Other Work Zone Personnel.** For other work zone personnel, the Contractor may provide training meeting the curriculum shown below instead of Department-approved training.

Minimum curriculum for Contractor-provided training is as follows:

Contractor-developed training must provide information on the use of personnel protection equipment, occupational hazards and health risks, and other pertinent topics related to traffic management. The type and amount of training will depend on the job duties and responsibilities. Develop training applicable to the work being performed. Develop training to include the following topics.

- The Life You Save May Be Your Own (or other similar company safety motto).
- Purpose of the training.
  - It's the Law.
  - To make work zones safer for workers and motorist.
  - To understand what is needed for traffic control.
  - To save lives including your own.
- Personal and Co-Worker Safety.
  - **High Visibility Safety Apparel.** Discuss compliant requirements; inspect regularly for fading and reduced reflective properties; if night operations are required, discuss the additional and appropriate required apparel in addition to special night work risks; if moving operations are underway, discuss appropriate safety measures specific to the situation and traffic control plan.
  - **Blind Areas.** A blind area is the area around a vehicle or piece of construction equipment not visible to the operators, either by line of sight or indirectly by mirrors. Discuss the "Circle of Safety" around equipment and vehicles; use of spotters; maintain eye contact with equipment operators; and use of hand signals.
  - **Runovers and Backovers.** Remain alert at all times; keep a safe distance from traffic; avoid turning your back to traffic and if you must then use a spotter; and stay behind protective barriers, whenever possible. Note: It is not safe to sit on or lean against a concrete barrier, these barriers can deflect four plus feet when struck by a vehicle.
  - Look out for each other, warn co-workers.
  - Be courteous to motorists.
  - Do not run across active roadways.
  - Workers must obey traffic laws and drive courteously while operating vehicles in the work zones.
  - Workers must be made aware of company distracted driving policies.
- **Night Time Operations.** Focus should be placed on projects with a nighttime element.

- **Traffic Control Training.** Basics of Traffic Control.
  - Identify work zone traffic control supervisor and other appropriate persons to report issues to when they arise.
  - Emphasize that work zone traffic control devices must be in clean and in undamaged condition. If devices have been hit but not damaged, put back in their correct place and report to traffic control supervisor. If devices have been damaged, replace with new one and report to traffic control supervisor. If devices are dirty, faded or have missing or damaged reflective tape clean or replace and report to traffic control supervisor. Show examples of non-acceptable device conditions. Discuss various types of traffic control devices to be used and where spacing requirements can be found.
  - **Channelizing Devices and Barricades with Slanted Stripes.** Stripes are to slant in the direction you want traffic to stay or move to; demonstrate this with a device.
  - **Traffic Queuing.** Workers must be made aware of traffic queuing and the dangers created by it. Workers must be instructed to immediately notify the traffic control supervisor and other supervisory personnel if traffic is queuing beyond advance warning sign and devices or construction limits.
  - **Signs.** Signs must be straight and not leaning. Report problems to the traffic control supervisor or other as designated for immediate repair. Covered signs must be fully covered. If covers are damaged or out of place, report to traffic control supervisor or other as designated.

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## Special Provision to Item 8 Prosecution and Progress

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Item 8, "Prosecution and Progress" of the Standard Specification is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 8.2., "Subcontracting,"** is supplemented by the following paragraph, which is added as paragraph six to this article:

The Contractor certifies by signing the Contract that the Contractor will not enter into any subcontract with a subcontractor that is not registered in the Department of Homeland Security's (DHS) E-Verify system. Require that all subcontractors working on the project register and require that all subcontractors remain active in the DHS E-Verify system until their work is complete on the project.

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## Special Provision to Item 8 Prosecution and Progress

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Item 8, "Prosecution and Progress" of the Standard Specifications is amended with respect to the clause cited below. No other clauses or requirements of this Item are waived or changed.

**Article 8.7.2., "Wrongful Default,"** is revised and replaced by the following:

If it is determined after the Contractor is declared in default, that the Contractor was not in default, the rights and obligations of all parties will be the same as if termination had been issued for the convenience of the public as provided in Article 8.8 "Termination of Contract."

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## Special Provision to Item 009

### Measurement and Payment

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Item 009 "Measurement and Payment" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 9.5., "PROGRESS PAYMENTS" is supplemented with the following:**

It is the Department's desire to pay a Contractor for work through the last working day of the month; however, the use of early cut-off dates for monthly estimates and MOH is a project management practice to manage workload at the Area Office level. Approval for using early cut-off dates is at the District's discretion. The earliest cut-off date for estimates is the 25<sup>th</sup> of the month.

**Article 9.6., "PAYMENT FOR MATERIAL ON HAND (MOH)" first paragraph is amended as follows:**

If payment for MOH is desired, request compensation for the invoice cost of acceptable nonperishable materials that have not been used in the work before the request, and that have been delivered to the work location or are in acceptable storage places. Nonperishable materials are those that do not have a shelf life or whose characteristics do not materially change when exposed to the elements. Include only materials that have been sampled, tested, approved, or certified, and are ready for incorporation into the work. Only materials which are completely constructed or fabricated on the Contractor's order for a specific Contract and are so marked and on which an approved test report has been issued are eligible. Payment for MOH may include the following types of items: concrete traffic barrier, precast concrete box culverts, concrete piling, reinforced concrete pipe, and illumination poles. Any repairs required after fabricated materials have been approved for storage will require approval of the Engineer before being made and will be made at the Contractor's expense. Include only those materials and products, when cumulated under an individual item or similar bid items, that have an invoice cost of at least \$1,000 in the request for MOH payment (e.g. For MOH eligibility, various sizes of conductor are considered similar bid items and may be cumulated to meet the threshold; for small roadside signs, the sign supports, mounting bolts, and the sign face is considered one bid item or similar bid items for more than one pay item for sign supports.) Requests for MOH are to be submitted at least two days before but not later than the estimate cutoff date unless otherwise agreed. If there is a need to request MOH after the established cut-off date, the district can make accommodation as the need arises. This needed accommodation is to be the exception, though, and not the rule.

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## Special Provision to Item 9 Measurement and Payment

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Item 9, "Measurement and Payment" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Section 9.7.1.4.3., "Standby Equipment Costs,"** is voided and replaced by the following:

7.1.4.3. **Standby Equipment Costs.** Payment for standby equipment will be made in accordance with Section 9.7.1.4., "Equipment," except that the 15% markup will not be allowed and that:

**Section 7.1.4.3.1., "Contractor-Owned Equipment,"** is voided and replaced by the following:

7.1.4.3.1. **Contractor-Owned Equipment.** For Contractor-owned equipment:

- Standby will be paid at 50% of the monthly Equipment Watch rate after the regional and age adjustment factors have been applied. Operating costs will not be allowed. Calculate the standby rate as follows.

$$\text{Standby rate} = (\text{FHWA hourly rate} - \text{operating costs}) \times 50\%$$

- If an hourly rate is needed, divide the monthly *Equipment Watch* rate by 176.
- No more than 8 hr. of standby will be paid during a 24-hr. day period, nor more than 40 hr. per week.
- Standby costs will not be allowed during periods when the equipment would have otherwise been idle.

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## Special Provision to Item 300 Asphalt, Oils, and Emulsions

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Item 300, "Asphalt, Oils, and Emulsions" of the Standard Specifications is replaced by Special Specification [3096](#), "Asphalts, Oils, and Emulsions." All Item 300 Special Provisions are no longer available, beginning with the April 2022 letting.

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## Special Provision to Item 316

### Seal Coat

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Item 316, "Seal Coat" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Section 4.8, "Asphalt Placement"** is supplemented by the following:

4.8.5. Collect all samples in accordance with Tex-500-C, "Sampling Bituminous Materials, Pre-Molded Joint Fillers, and Joint Sealers" from the distributor and with witness by the Engineer.

At least once per project, collect split samples of each binder grade and source used. The Engineer will submit one split sample to MTD for testing and retain the other split sample.

In addition, collect one sample of each binder grade and source used on the project for each production day. The Engineer will retain these samples.

The Engineer will keep all retained samples for one yr., for hot-applied binders and cutback asphalts; or for two mo., for emulsified asphalts. The Engineer may submit retained samples to MTD for testing as necessary or as requested by MTD.



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## Special Provision to Item 342 Permeable Friction Course (PFC)

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Item 342, "Permeable Friction Course (PFC)" of the Standard Specifications is replaced by Special Specification [3079](#), "Permeable Friction Course." All Item 342 Special Provisions and bid codes are no longer available, beginning with the April 2022 letting.

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## Special Provision to Item 344 Superpave Mixtures

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Item 344, "Superpave Mixtures" of the Standard Specifications is replaced by Special Specification [3077](#), "Superpave Mixtures." All Item 344 Special Provisions and bid codes are no longer available, beginning with the February 2020 letting.

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## Special Provision to Item 348 Thin Bonded Friction Courses

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Item 348, "Thin Bonded Friction Courses" of the Standard Specifications is replaced by Special Specification [3082](#), "Thin Bonded Friction Courses." All Item 348 Special Provisions and bid codes are no longer available, beginning with the April 2022 letting.

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## Special Provision to Item 502

### Barricades, Signs and Traffic Handling

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Item 502, "Barricades, Signs and Traffic Handling" of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

**Article 502.1., "Description,"** is supplemented by the following:

Temporary work-zone (TWZ) traffic control devices manufactured after December 31, 2019, must have been successfully tested to the crashworthiness requirements of the 2016 edition of the Manual for Assessing Safety Hardware (MASH). Such devices manufactured on or before this date and successfully tested to NCHRP Report 350 or the 2009 edition of MASH may continue to be used throughout their normal service lives. An exception to the manufacture date applies when, based on the project's date of letting, a category of MASH-2016 compliant TWZ traffic control devices are not approved, or are not self-certified after the December 31, 2019, date. In such case, devices that meet NCHRP-350 or MASH-2009 may be used regardless of the manufacture date.

Such TWZ traffic control devices include: portable sign supports, barricades, portable traffic barriers designated exclusively for use in temporary work zones, crash cushions designated exclusively for use in temporary work zones, longitudinal channelizers, truck and trailer mounted attenuators. Category I Devices (i.e., lightweight devices) such as cones, tubular markers and drums without lights or signs attached however, may be self-certified by the vendor or provider, with documentation provided to Department or as are shown on Department's Compliant Work Zone Traffic Control Device List.

**Article 502.4., "Payment,"** is supplemented by the following:

Truck mounted attenuators and trailer attenuators will be paid for under Special Specification, "Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)." Portable Changeable Message Signs will be paid for under Special Specification, "Portable Changeable Message Sign." Portable Traffic Signals will be paid for under Special Specification, "Portable Traffic Signals."

# Special Provision to Item 506

## Temporary Erosion, Sedimentation, and Environmental Controls



For this project, Item 506, "Temporary Erosion, Sedimentation, and Environmental Controls," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

**Article 506.1., "Description,"** is voided and replaced by the following:

Install, maintain, and remove erosion, sedimentation, and environmental control measures to prevent or reduce the discharge of pollutants in accordance with the Storm Water Pollution Prevention Plan (SWP3) or as directed. Ensure the installation and maintenance of control measures is performed in accordance with the manufacturer's or designer's specifications. Erosion and sediment control devices must be selected from the "Erosion Control Approved Products" or "Sediment Control Approved Products" lists. Perform work in a manner to prevent degradation of receiving waters, facilitate project construction, and comply with applicable federal, state, and local regulations.

**Article 506.3., "Qualifications, Training, and Employee Requirements,"** is voided and not replaced.

**Section 506.4.1., "Contractor Responsibilities," Section 506.4.2., "Implementation," and Section 506.4.3., "General,"** are voided and replaced by the following:

4.1. **Contractor Responsibilities.** Implement the SWP3 for the project site in accordance with the plans and specifications, and as directed. Coordinate storm water management with all other work on the project. Develop and implement an SWP3 for project-specific material supply plants within and outside of the Department's right of way in accordance with the specific or general storm water permit requirements. Prevent water pollution from storm water associated with construction activity from entering any surface water or private property on or adjacent to the project site.

4.2. **Implementation.**

4.2.1. **Commencement.** Implement the SWP3 as shown and as directed. Contractor proposed recommendations for changes will be allowed as approved. Do not implement changes until approval has been received and changes have been incorporated into the plans by the Engineer. Minor adjustments to meet field conditions are allowed and will be recorded by the Engineer in the SWP3.

Implement control measures before the commencement of activities that result in soil disturbance. Phase and minimize the soil disturbance to the areas shown on the plans. Coordinate temporary control measures with permanent control measures and all other work activities on the project to assure economical, effective, safe, continuous water pollution prevention. Provide control measures that are appropriate to the construction means, methods, and sequencing allowed by the Contract.

Do not prolong final grading and shaping. Preserve vegetation where possible throughout the project and minimize clearing, grubbing, and excavation within stream banks, bed, and approach sections.

4.3. **General.**

4.3.1. **Temporary Alterations or Control Measure Removal.** Altering or removal of control measures is allowed when control measures are restored within the same working day.

- 4.3.2. **Stabilization.** Initiate stabilization for disturbed areas no more than 14 days after the construction activities in that portion of the site has temporarily or permanently ceased. Establish a uniform vegetative cover or use another stabilization practice as approved.
- 4.3.3. **Finished Work.** Upon the Engineer's acceptance of vegetative cover or other stabilization practice, remove and dispose of all temporary control measures unless otherwise directed. Complete soil disturbing activities and establish a uniform perennial vegetative cover. A project will not be considered for acceptance until a vegetative cover of 70% density of existing adjacent undisturbed areas is obtained or equivalent permanent stabilization is obtained as approved.
- 4.3.4. **Restricted Activities and Required Precautions.** Do not discharge onto the ground or surface waters any pollutants such as chemicals, raw sewage, fuels, lubricants, coolants, hydraulic fluids, bitumens, or any other petroleum product. Operate and maintain equipment on site in a manner as to prevent actual or potential water pollution. Manage, control, and dispose of litter on site such that no adverse impacts to water quality occur. Prevent dust from creating a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property. Wash out concrete trucks only in approved contained areas. Use appropriate controls to minimize the offsite transport of suspended sediments and other pollutants if it is necessary to pump or channel standing water (i.e. dewatering). Prevent discharges that would contribute to a violation of Edwards Aquifer Rules, water quality standards, the impairment of a listed water body, or other state or federal law.

**Section 506.4.4., "Installation, Maintenance, and Removal Work."** The first paragraph is voided and replaced by the following.

Perform work in accordance with the SWP3, and according to the manufacturers' guidelines. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until soil disturbing activities are completed and permanent erosion control features are in place or the disturbed area has been adequately stabilized as determined by the Engineer.

**Section 506.4.5., "Monitoring and Documentation,"** is voided and not replaced.

**Section 506.6.5.2., "Maintenance Earthwork for Erosion and Sediment Control for Cleaning and/or Restoring Control Measures,"** is voided and replaced by the following:

Earthwork needed to remove and obliterate of erosion-control features will not be paid for directly but is subsidiary to pertinent Items unless otherwise shown on the plans.

Sprinkling and rolling required by this Item will not be paid for directly but will be subsidiary to this Item.

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## Special Provision to Item 520

### Weighing and Measuring Equipment

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Item 520, "Weighing and Measuring Equipment" of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Article 520.2., "Equipment."** The third paragraph is voided and replaced by the following.

Calibrate truck scales using weights certified by the Texas Department of Agriculture (TDA) or an equivalent agency as approved. Provide a written calibration report from a scale mechanic for truck scale calibrations. Cease plant operations during the checking operation. Do not use inaccurate or inadequate scales. Bring performance errors as close to zero as practicable when adjusting equipment.

**Article 520.2., "Equipment."** The fourth paragraph is amended to include the following:

At the Contractors option, an electronic ticket delivery system (e-ticketing) may be used instead of printed tickets. The use of e-ticketing will require written approval of the Engineer. At a minimum, the approved system will:

- Provide electronic, real-time e-tickets meeting the requirements of the applicable bid items;
- Automatically generate e-tickets using software and hardware fully integrated with the automated scale system used to weigh the material, and be designed in such a way that data input cannot be altered by the Contractor or the Engineer;
- Provide the Engineer access to the e-ticketing data in real-time with a web-based or app-based system compatible with iOS;
- Provide offline capabilities to prevent data loss if power or connectivity is lost;
- Require both the Contractor and the Engineer to accept or reject the e-ticket and provide the ability to record the information required by the applicable bid items, as well as any comments. Record the time of the approval/rejection and include it in the summary spreadsheet described below. Provide each party the capability to edit their respective actions and any entered information;

The Contractor may discontinue use of the e-ticket system and provide printed tickets as needed to meet the requirements of the applicable bid items.

# Special Provision to Item 666

## Retroreflectorized Pavement Markings



Item 666, "Retroreflectorized Pavement Markings," of the Standard Specifications is amended with respect to the clauses cited below. No other clauses or requirements of this Item are waived or changed.

**Section 2.3., "Glass Traffic Beads."** The first paragraph is voided and replaced by the following:

Furnish drop-on glass beads in accordance with DMS-8290, "Glass Traffic Beads," or as approved. Furnish a double-drop of Type II and Type III drop-on glass beads for longitudinal pavement markings where each type bead is applied separately in equal portions (by weight), unless otherwise approved. Apply the Type III beads before applying the Type II beads. Furnish Type II beads for work zone pavement markings and transverse markings or symbols.

**Section 4.3.1., "Type I Markings.,"** is supplemented by the following:

**4.3.1.3. Spot Striping.** Perform spot striping on a callout basis with a minimum callout quantity as shown on the plans.

**Section 4.3.2., "Type II Markings.,"** is supplemented by the following:

**4.3.2.1. Spot Striping.** Perform spot striping on a callout basis with a minimum callout quantity as shown on the plans.

**Section 4.4., "Retroreflectivity Requirements.,"** is voided and replaced by the following.

Type I markings for Contracts totaling more than 20,000 ft. of pavement markings must meet the following minimum retroreflectivity values for all longitudinal edgeline, centerline or no passing barrier-line, and lane line markings when measured any time after 3 days, but not later than 10 days after application.

- White markings: 250 millicandelas per square meter per lux (mcd/m<sup>2</sup>/lx)
- Yellow markings: 175 mcd/m<sup>2</sup>/lx

Retroreflectivity requirements for Type I markings are not required for Contracts with less than 20,000 ft. of pavement markings or Contracts with callout work, unless otherwise shown on the plans.

**Section 4.5., "Retroreflectivity Measurements.,"** is voided and replaced by the following:

Use a mobile retroreflectometer to measure retroreflectivity for Contracts totaling more than 50,000 ft. of pavement markings, unless otherwise shown on the plans. For Contracts with less than 50,000 ft. of pavement markings, mobile or portable retroreflectometers may be used at the Contractor's discretion. Coordinate with and obtain authorization from the Engineer before starting any retroreflectivity data collection.

**Section 4.5.1., "Mobile Retroreflectometer Measurements."** The last paragraph is voided and replaced by the following.

Restripe again at the Contractor's expense with a minimum of 0.060 in. (60 mils) of Type I marking material if the average of these measurements falls below the minimum retroreflectivity requirements. Take measurements every 0.1 miles a minimum of 10 days after this third application within that mile segment for that series of markings. If the markings do not meet minimum retroreflectivity after this third application, the Engineer may require removal of all existing markings, a new application as initially specified, and a repeat of the application process until minimum retroreflectivity requirements are met.



**Section 4.5.2., "Portable Retroreflector Measurements."** The first and second paragraphs are voided and replaced by the following.

Provide portable measurement averages for every 1.0 mile unless otherwise specified or approved. Take a minimum of 20 measurements for each 1-mi. section of roadway for each series of markings (e.g., edgeline, center skip line, each line of a double line) and direction of traffic flow when using a portable reflectometer. Measure each line in both directions for centerlines on two-way roadways (i.e., measure both double solid lines in both directions and measure all center skip lines in both directions). The spacing between each measurement must be at least 100 ft. The Engineer may decrease the mileage frequency for measurements if the previous measurements provide satisfactory results. The Engineer may require the original number of measurements if concerns arise.

Restripe at the Contractor's expense with a minimum of 0.060 in. (60 mils) of Type I marking material if the averages of these measurements fail. Take a minimum of 10 more measurements after 10 days of this second application within that mile segment for that series of markings. Restripe again at the Contractor's expense with a minimum of 0.060 in. (60 mils) of Type I marking material if the average of these measurements falls below the minimum retroreflectivity requirements. If the markings do not meet minimum retroreflectivity after this third application, the Engineer may require removal of all existing markings, a new application as initially specified, and a repeat of the application process until minimum retroreflectivity requirements are met.

**Section 4.6. "Performance Period."** The first sentence is voided and replaced by the following:

All longitudinal markings must meet the minimum retroreflectivity requirements within the time frame specified. All markings must meet all other performance requirements of this specification for at least 30 calendar days after installation.

**Article 6. "Payment."** The first two paragraphs are voided and replaced by the following.

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 "Pavement Sealer" of the size specified; "Retroreflectorized Pavement Markings" of the type and color specified and the shape, width, size, and thickness (Type I markings only) specified, as applicable; "Retroreflectorized Pavement Markings with Retroreflective Requirements" of the types, colors, sizes, widths, and thicknesses specified; "Retroreflectorized Profile Pavement Markings" of the various types, colors, shapes, sizes, and widths specified; or "Reflectorized Pavement Marking (Call Out)" of the shape, width, size, and thickness (Type I markings only) specified, as applicable; or "Pavement Sealer (Call Out)" of the size specified.

This price is full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals.

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## Special Provision to Special Specification 6185 Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)

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Item 6185, "Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)" of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

**Article 4. "Measurement"**, is voided and replaced by the following:

- 4.1. **Truck Mounted Attenuator/Trailer Attenuator (Stationary).** This Item will be measured by the day. TMA/TAs must be set up in a work area and operational before a calendar day can be considered measurable. A day will be measured for each TMA/TA set up and operational on the worksite.
- 4.2. **Truck Mounted Attenuator/Trailer Attenuator (Mobile Operation).** This Item will be measured by the hour or by the day. The time begins once the TMA/TA is ready for operation at the predetermined site and stops when notified by the Engineer. When measurement by the hour is specified, a minimum of 4 hr. will be paid each day for each operating TMA/TA used in a mobile operation. When measurement by the day is specified, a day will be measured for each TMA/TA set up and operational on the worksite.

# Special Specification 3002

## Spray Applied Underseal Membrane



### 1. DESCRIPTION

Construct an underseal membrane composed of a warm spray-applied polymer-modified emulsion meeting the requirements of Table 1. The membrane is applied through a spray-paver and is covered immediately with a mixture of aggregate, asphalt binder, and additives mixed hot in a mixing plant.

**Table 1**  
**Polymer-Modified Emulsions Requirements**

| Test on Emulsion  | Test Method | Min | Max  |
|---|-------------|-----|------|
| Viscosity @ 77°F, SSF   | Tex-513-C   | 20  | 100  |
| Storage Stability <sup>1</sup> , %  | Tex-521-C   |     | 1    |
| Demulsibility <sup>2</sup><br>Anionic emulsions — 35 ml of 0.02 N CaCl <sub>2</sub> , %<br>Cationic emulsions — 35 ml 0.8% sodium dioctyl sulfosuccinate, % | Tex-521-C   | 55  |      |
| Sieve Test <sup>3</sup> , %   | Tex-521-C   |     | 0.05 |
| Distillation Test <sup>4</sup><br>Residue by distillation, % by wt.<br>Oil portion of distillate, % by vol.   | Tex-521-C   | 63  | 0.5  |
| Test on Residue from Distillation   | Test Method | Min | Max  |
| Elastic Recovery @ 50°F, 50 mm/min., %  | Tex-539-C   | 60  |      |
| Penetration @ 77°F, 100 g, 5 sec, 0.1 mm  | Tex-502-C   | 100 | 150  |

- After standing undisturbed for 24 hr., the surface must be smooth, must not exhibit a white or milky colored substance, and must be a homogeneous color throughout.
- Material must meet demulsibility test for emulsions.
- May be required by the Engineer only when the emulsion cannot be easily applied in the field.
- The temperature on the lower thermometer should be brought slowly to 350°F ±10°F and maintained at this temperature for 20 min. The total distillation should be complete in 60 ±5 min. from the first application of heat.

### 2. EQUIPMENT

- Spray Paver.** In addition to the requirements of Item 320, "Equipment for Asphalt Concrete Pavement," furnish a spray paver that will spray the membrane and apply the type and grade of mix shown on the plans and level the surface of the pavement layer in a single pass. Configure the spray paver so that the mixture is placed no more than 5 sec. after the membrane is applied.
- Membrane Storage Tank and Distribution System.** Equip the spray paver with an insulated storage tank having a minimum capacity of 900 gal., unless otherwise approved. Provide a metered mechanical pressure sprayer on the spray paver to apply the membrane at the specified rate. Locate the spray bar on the spray paver so that the membrane is applied immediately in front of the screed unit. Provide a read out device on the spray paver to monitor the membrane application rate.

Unless otherwise directed, furnish a volumetric calibration and strap stick for the tank in accordance with Tex-922-K, Part I. Calibrate the tank within the previous 5 yr. of the date first used on the project. The Engineer may verify calibration accuracy in accordance with Tex-922-K, Part II.

### 3. CONSTRUCTION METHODS

- Surface Preparation.** Remove existing raised pavement markers. Repair any damage incurred by removal as directed. Remove dirt, dust, or other harmful material before sealing. When shown on the plans, remove vegetation and blade pavement edges.

- 3.2. **Membrane Placement.** Unless otherwise directed, uniformly apply the membrane at a rate between 0.15 and 0.25 gal. per square yard. The Engineer may adjust the application rate, taking into consideration the existing pavement surface conditions. Spray the membrane using a metered mechanical pressure spray bar at a temperature between 140°F to 180°F. Monitor the membrane application rate and adjust the rate when needed or when directed. If required, verify that the spray bar is capable of applying the membrane at a uniform rate across the entire paving width as directed. Do not let the wheels or other parts of the paving machine contact the freshly applied membrane. Apply a uniform membrane coat to all contact surfaces and all joints as shown on the plans. Prevent splattering of the membrane when placed adjacent to curb, gutter, and other structures.
- 3.3. **Quality Control.** Perform the quality control tests listed in Table 2. If operational tolerances in Table 2 are exceeded, adjust processes or cease production when directed. The Engineer may perform independent tests to confirm contractor compliance and may require testing differences or failing results to be resolved before resuming production.
- 3.4. **Membrane Sampling.** Obtain a 1-qt. sample of the polymer-modified emulsion for each lot of mixture produced. The Engineer will witness the sampling of polymer-modified emulsion. Take the sample from the emulsion tank located on the paving machine, but not from the emulsion spraybar. Obtain the sample at approximately the same time the mixture random sample is obtained. Take all samples in accordance with Tex-500-C, Part III. Label the can with the corresponding lot and subplot numbers, and immediately deliver the sample to the Engineer. The Engineer will randomly choose at least 1 sample per project and test it to verify compliance with Table 1.

**Table 2  
Operational Tolerance and Minimum Testing Frequency**

| Test Description                        | Test Method | Minimum Testing Frequency | Operational Tolerance |
|---|-------------|---------------------------|-----------------------|
| Membrane Application Rate               | Tex-247-F   | 1 per day                 | ±0.02                 |
| Emulsion Membrane Sampling <sup>1</sup> | Tex-500-C   | 1 per day (sample only)   | Table 1               |

1. The Engineer may reduce or waive the sampling and testing requirements based on a satisfactory history.

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#### 4. MEASUREMENT

Unless otherwise noted on the plans, underseal membrane material will be measured by one of the following methods:

- 4.1. **Volume.** Underseal membrane material will be measured at the applied temperature by strapping the tank before and after road application and determining the net volume in gallons from the distributor’s calibrated strap stick. The Engineer will witness all strapping operations for volume determination.

If the meter and readout device is accurate within 1.5% of the strapped asphalt volume, the Engineer may allow use of the meter and readout to determine asphalt volume used and application rate.

The Engineer may require redetermination of meter readout at any time and will require volume determinations by strapping if the meter is not accurate to within 1.5% of strapped volume.

- 4.2. **Weight.** Underseal membrane material will be measured in tons using certified scales meeting the requirements of Item 320, “Equipment for Asphalt Concrete Pavement,” unless otherwise approved. The transporting truck must have a seal attached to the driving device and other openings. The Engineer may require random checking on public scales, at the Contractor’s expense, to verify weight accuracy.

Upon completion or temporary suspension, any remaining membrane material will be weighed by a certified public weigher or measured by volume in a calibrated tank, and the quantity converted to tons at the measured temperature. The quantity to be measured will be the number of tons received, minus the number of tons remaining after all directed work is complete, and minus the amount used for other Items.

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**5. PAYMENT**

The work performed and materials furnished in accordance with this Item and measured as provided above will be paid for at the unit bid price for "Membrane Underseal." These prices are full compensation for all materials, equipment, labor, tools, and incidentals necessary to complete the work.

# Special Specification 3077

## Superpave Mixtures



### 1. DESCRIPTION

Construct a hot-mix asphalt (HMA) pavement layer composed of a compacted, Superpave (SP) mixture of aggregate and asphalt binder mixed hot in a mixing plant. Payment adjustments will apply to HMA placed under this specification unless the HMA is deemed exempt in accordance with Section 3077.4.9.4., "Exempt Production."

### 2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

2.1. **Aggregate.** Furnish aggregates from sources that conform to the requirements shown in Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse, intermediate, or fine aggregate. Aggregate from reclaimed asphalt pavement (RAP) is not required to meet Table 1 requirements unless otherwise shown on the plans. Supply aggregates that meet the definitions in [Tex-100-E](#) for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in [Tex-200-F](#), Part II.

2.1.1. **Coarse Aggregate.** Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance; and
- once approved, do not add material to the stockpile unless otherwise approved.

Provide aggregate from non-listed sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources.

Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes. SAC requirements apply to aggregates used on surfaces other than travel lanes when shown on the plans. The SAC for sources on the Department's *Aggregate Quality Monitoring Program* (AQMP) ([Tex-499-A](#)) is listed in the BRSQC.

- 2.1.1.1. **Blending Class A and Class B Aggregates.** Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate to meet requirements for Class A materials, unless otherwise shown on the plans. Ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source when blending Class A and B aggregates to meet a Class A requirement unless otherwise shown on the plans. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. Coarse aggregate from RAP and Recycled Asphalt Shingles (RAS) will be considered as Class B aggregate for blending purposes.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 4 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

- 2.1.1.2. **Micro-Deval Abrasion.** The Engineer will perform a minimum of one Micro-Deval abrasion test in accordance with [Tex-461-A](#) for each coarse aggregate source used in the mixture design that has a Rated Source Soundness Magnesium (RSSM) loss value greater than 15 as listed in the BRSQC. The Engineer will perform testing before the start of production and may perform additional testing at any time during production. The Engineer may obtain the coarse aggregate samples from each coarse aggregate source or may require the Contractor to obtain the samples. The Engineer may waive all Micro-Deval testing based on a satisfactory test history of the same aggregate source.

The Engineer will estimate the magnesium sulfate soundness loss for each coarse aggregate source, when tested, using the following formula:

$$Mg_{est.} = (RSSM)(MD_{act.}/RSMD)$$

where:

$Mg_{est.}$  = magnesium sulfate soundness loss

$MD_{act.}$  = actual Micro-Deval percent loss

$RSMD$  = Rated Source Micro-Deval

When the estimated magnesium sulfate soundness loss is greater than the maximum magnesium sulfate soundness loss specified, the coarse aggregate source will not be allowed for use unless otherwise approved. The Engineer will consult the Soils and Aggregates Section of the Materials and Tests Division, and additional testing may be required before granting approval.

- 2.1.2. **Intermediate Aggregate.** Aggregates not meeting the definition of coarse or fine aggregate will be defined as intermediate aggregate. Supply intermediate aggregates, when used that are free from organic impurities. The Engineer may test the intermediate aggregate in accordance with [Tex-408-A](#) to verify the material is free from organic impurities. Supply intermediate aggregate from coarse aggregate sources, when used that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve, and verify that it meets the requirements in Table 1 for crushed face count ([Tex-460-A](#)) and flat and elongated particles ([Tex-280-F](#)).

2.1.3.

**Fine Aggregate.** Fine aggregates consist of manufactured sands, screenings, and field sands. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with [Tex-408-A](#) to verify the material is free from organic impurities. Unless otherwise shown on the plans, up to 10% of the total aggregate may be field sand or other uncrushed fine aggregate. Use fine aggregate, with the exception of field sand, from coarse aggregate sources that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve and verify that it meets the requirements in Table 1 for crushed face count ([Tex-460-A](#)) and flat and elongated particles ([Tex-280-F](#)).

**Table 1**  
**Aggregate Quality Requirements**

| Property                                      | Test Method                         | Requirement           |
|---|-------------------------------------|-----------------------|
| <b>Coarse Aggregate</b>                       |                                     |                       |
| SAC   | <a href="#">Tex-499-A</a> (AQMP)    | As shown on the plans |
| Deleterious material, %, Max                  | <a href="#">Tex-217-F</a> , Part I  | 1.0                   |
| Decantation, %, Max                           | <a href="#">Tex-217-F</a> , Part II | 1.5                   |
| Micro-Deval abrasion, %                       | <a href="#">Tex-461-A</a>           | Note 1                |
| Los Angeles abrasion, %, Max                  | <a href="#">Tex-410-A</a>           | 35 <sup>2</sup>       |
| Magnesium sulfate soundness, 5 cycles, %, Max | <a href="#">Tex-411-A</a>           | 25 <sup>3</sup>       |
| Crushed face count, <sup>4</sup> %, Min       | <a href="#">Tex-460-A</a> , Part I  | 85                    |
| Flat and elongated particles @ 5:1, %, Max    | <a href="#">Tex-280-F</a>           | 10                    |
| <b>Fine Aggregate</b>                         |                                     |                       |
| Linear shrinkage, %, Max                      | <a href="#">Tex-107-E</a>           | 3                     |
| Sand equivalent, %, Min                       | <a href="#">Tex-203-F</a>           | 45                    |

- Used to estimate the magnesium sulfate soundness loss in accordance with Section 3077.2.1.1.2., "Micro-Deval Abrasion."
- For base mixtures defined in Section 3077.2.7., "Recycled Materials," the Los Angeles abrasion may be increased to a maximum of 40%.
- For base mixtures defined in Section 3077.2.7., "Recycled Materials," the magnesium sulfate soundness, five cycles, may be increased to a maximum of 30%.
- Only applies to crushed gravel.

**Table 2**  
**Gradation Requirements for Fine Aggregate**

| Sieve Size | % Passing by Weight or Volume |
|------------|-------------------------------|
| 3/8"       | 100                           |
| #8         | 70–100                        |
| #200       | 0–30                          |

2.2.

**Mineral Filler.** Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Use no more than 2% hydrated lime or fly ash unless otherwise shown on the plans. Use no more than 1% hydrated lime if a substitute binder is used unless otherwise shown on the plans or allowed. Test all mineral fillers except hydrated lime and fly ash in accordance with [Tex-107-E](#) to ensure specification compliance. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:

- is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
- does not exceed 3% linear shrinkage when tested in accordance with [Tex-107-E](#); and
- meets the gradation requirements in Table 3, unless otherwise shown on the plans.

**Table 3**  
**Gradation Requirements for Mineral Filler**

| Sieve Size | % Passing by Weight or Volume |
|------------|-------------------------------|
| #8         | 100                           |
| #200       | 55–100                        |

2.3.

**Baghouse Fines.** Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.



- 2.4. **Asphalt Binder.** Furnish the type and grade of performance-graded (PG) asphalt specified on the plans.
- 2.5. **Tack Coat.** Furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, "Asphalts, Oils, and Emulsions." Specialized tack coat materials listed on the Department's MPL are allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.
- 2.6. **Additives.** Use the type and rate of additive specified when shown on the plans. Additives that facilitate mixing, compaction, or improve the quality of the mixture are allowed when approved. Provide the Engineer with documentation such as the bill of lading showing the quantity of additives used in the project unless otherwise directed.
- 2.6.1. **Lime and Liquid Antistripping Agent.** When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.
- 2.6.2. **Warm Mix Asphalt (WMA).** Warm Mix Asphalt (WMA) is defined as HMA that is produced within a target temperature discharge range of 215°F and 275°F using approved WMA additives or processes from the Department's MPL.
- WMA is allowed for use on all projects and is required when shown on the plans. When WMA is required, the maximum placement or target discharge temperature for WMA will be set at a value below 275°F.
- Department-approved WMA additives or processes may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures above 275°F; however, such mixtures will not be defined as WMA.
- 2.6.3. **Compaction Aid.** Compaction Aid is defined as a chemical warm mix additive that is used to produce an asphalt mixture at a discharge temperature greater than 275°F.
- Compaction Aid is allowed for use on all projects and is required when shown on the plans.
- 2.7. **Recycled Materials.** Use of RAP and RAS is permitted unless otherwise shown on the plans. Use of RAS is restricted to only intermediate and base mixes unless otherwise shown on the plans. Do not exceed the maximum allowable percentages of RAP and RAS shown in Table 4. The allowable percentages shown in Table 4 may be decreased or increased when shown on the plans. Determine the asphalt binder content and gradation of the RAP and RAS stockpiles for mixture design purposes in accordance with [Tex-236-F](#), Part I. The Engineer may verify the asphalt binder content of the stockpiles at any time during production. Perform other tests on RAP and RAS when shown on the plans. Asphalt binder from RAP and RAS is designated as recycled asphalt binder. Calculate and ensure that the ratio of the recycled asphalt binder to total binder does not exceed the percentages shown in Table 5 during mixture design and HMA production when RAP or RAS is used. Use a separate cold feed bin for each stockpile of RAP and RAS during HMA production.
- Surface, intermediate, and base mixes referenced in Tables 4 and 5 are defined as follows:
- **Surface.** The final HMA lift placed at the top of the pavement structure or placed directly below mixtures produced in accordance with Items 316, 342, 347, or 348;
  - **Intermediate.** Mixtures placed below an HMA surface mix and less than or equal to 8.0 in. from the riding surface; and
  - **Base.** Mixtures placed greater than 8.0 in. from the riding surface. Unless otherwise shown on the plans, mixtures used for bond breaker are defined as base mixtures.
- 2.7.1. **RAP.** RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement. Fractionated RAP is defined as a stockpile that contains RAP material with a minimum of 95.0% passing the 3/8-in. or 1/2-in.

sieve, before burning in the ignition oven, unless otherwise approved. The Engineer may allow the Contractor to use an alternate to the 3/8-in. or 1/2-in. screen to fractionate the RAP.

Use of Contractor-owned RAP including HMA plant waste is permitted unless otherwise shown on the plans. Department-owned RAP stockpiles are available for the Contractor's use when the stockpile locations are shown on the plans. If Department-owned RAP is available for the Contractor's use, the Contractor may use Contractor-owned fractionated RAP and replace it with an equal quantity of Department-owned RAP. Department-owned RAP generated through required work on the Contract is available for the Contractor's use when shown on the plans. Perform any necessary tests to ensure Contractor- or Department-owned RAP is appropriate for use. The Department will not perform any tests or assume any liability for the quality of the Department-owned RAP unless otherwise shown on the plans. The Contractor will retain ownership of RAP generated on the project when shown on the plans.

Do not use Department- or Contractor-owned RAP contaminated with dirt or other objectionable materials. Do not use Department- or Contractor-owned RAP if the decantation value exceeds 5% and the plasticity index is greater than eight. Test the stockpiled RAP for decantation in accordance with [Tex-406-A](#), Part I. Determine the plasticity index in accordance with [Tex-106-E](#) if the decantation value exceeds 5%. The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction or ignition.

Do not intermingle Contractor-owned RAP stockpiles with Department-owned RAP stockpiles. Remove unused Contractor-owned RAP material from the project site upon completion of the project. Return unused Department-owned RAP to the designated stockpile location.

**Table 4**  
**Maximum Allowable Amounts of RAP<sup>1</sup>**

| Maximum Allowable Fractionated RAP (%) |              |      |
|--|--------------|------|
| Surface                                | Intermediate | Base |
| 20.0                                   | 30.0         | 35.0 |

1. Must also meet the recycled binder to total binder ratio shown in Table 5.

#### 2.7.2.

**RAS.** Use of post-manufactured RAS or post-consumer RAS (tear-offs) is not permitted in surface mixtures unless otherwise shown on the plans. RAS may be used in intermediate and base mixtures unless otherwise shown on the plans. Up to 3% RAS may be used separately or as a replacement for fractionated RAP in accordance with Table 4 and Table 5. RAS is defined as processed asphalt shingle material from manufacturing of asphalt roofing shingles or from re-roofing residential structures. Post-manufactured RAS is processed manufacturer's shingle scrap by-product. Post-consumer RAS is processed shingle scrap removed from residential structures. Comply with all regulatory requirements stipulated for RAS by the TCEQ. RAS may be used separately or in conjunction with RAP.

Process the RAS by ambient grinding or granulating such that 100% of the particles pass the 3/8 in. sieve when tested in accordance with [Tex-200-F](#), Part I. Perform a sieve analysis on processed RAS material before extraction (or ignition) of the asphalt binder.

Add sand meeting the requirements of Table 1 and Table 2 or fine RAP to RAS stockpiles if needed to keep the processed material workable. Any stockpile that contains RAS will be considered a RAS stockpile and be limited to no more than 3.0% of the HMA mixture in accordance with Table 4.

Certify compliance of the RAS with [DMS-11000](#), "Evaluating and Using Nonhazardous Recyclable Materials Guidelines." Treat RAS as an established nonhazardous recyclable material if it has not come into contact with any hazardous materials. Use RAS from shingle sources on the Department's MPL. Remove substantially all materials before use that are not part of the shingle, such as wood, paper, metal, plastic, and felt paper. Determine the deleterious content of RAS material for mixture design purposes in accordance with [Tex-217-F](#), Part III. Do not use RAS if deleterious materials are more than 0.5% of the stockpiled RAS unless

otherwise approved. Submit a sample for approval before submitting the mixture design. The Department will perform the testing for deleterious material of RAS to determine specification compliance.

2.8.

**Substitute Binders.** Unless otherwise shown on the plans, the Contractor may use a substitute PG binder listed in Table 5 instead of the PG binder originally specified if using recycled materials, and if the substitute PG binder and mixture made with the substitute PG binder meet the following:

- the substitute binder meets the specification requirements for the substitute binder grade in accordance with Section 300.2.10., "Performance-Graded Binders;" and
- the mixture has less than 10.0 mm of rutting on the Hamburg Wheel test ([Tex-242-F](#)) after the number of passes required for the originally specified binder. Use of substitute PG binders may only be allowed at the discretion of the Engineer if the Hamburg Wheel test results are between 10.0 mm and 12.5 mm.

**Table 5**  
**Allowable Substitute PG Binders and Maximum Recycled Binder Ratios**

| Originally Specified PG Binder | Allowable Substitute PG Binder for Surface Mixes | Allowable Substitute PG Binder for Intermediate and Base Mixes | Maximum Ratio of Recycled Binder <sup>1</sup> to Total Binder (%) |              |      |
|--------------------------------|--|--|---|--------------|------|
|                                |  |  | Surface   | Intermediate | Base |
| 76-22 <sup>4,5</sup>           | 70-22  | 70-22  | 15.0  | 25.0         | 30.0 |
| 70-22 <sup>2,5</sup>           | N/A  | 64-22  | 15.0  | 25.0         | 30.0 |
| 64-22 <sup>2,3</sup>           | N/A  | N/A  | 15.0  | 25.0         | 30.0 |
| 76-28 <sup>4,5</sup>           | 70-28  | 70-28  | 15.0  | 25.0         | 30.0 |
| 70-28 <sup>2,5</sup>           | N/A  | 64-28  | 15.0  | 25.0         | 30.0 |
| 64-28 <sup>2,3</sup>           | N/A  | N/A  | 15.0  | 25.0         | 30.0 |

1. Combined recycled binder from RAP and RAS. RAS is not permitted in surface mixtures unless otherwise shown on the plans.
2. Binder substitution is not allowed for surface mixtures.
3. Binder substitution is not allowed for intermediate and base mixtures.
4. Use no more than 15.0% recycled binder in surface mixtures when using this originally specified PG binder.
5. Use no more than 25.0% recycled binder when using this originally specified PG binder for intermediate mixtures. Use no more than 30.0% recycled binder when using this originally specified PG binder for base mixtures.

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### 3. EQUIPMENT

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

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### 4. CONSTRUCTION

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a mandatory pre-paving meeting with the Engineer on or before the first day of paving unless otherwise shown on the plans.

4.1.

**Certification.** Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 6. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel

changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist. Provide Level 1A certified specialists at the plant during production operations. Provide Level 1B certified specialists to conduct placement tests. Provide AGG101 certified specialists for aggregate testing.

**Table 6**  
**Test Methods, Test Responsibility, and Minimum Certification Levels**

| Test Description                                  | Test Method                                  | Contractor | Engineer | Level <sup>1</sup> |
|---|--|------------|----------|--------------------|
| <b>1. Aggregate and Recycled Material Testing</b> |  |            |          |                    |
| Sampling  | <a href="#">Tex-221-F</a>                    | ✓          | ✓        | 1A/AGG101          |
| Dry sieve   | <a href="#">Tex-200-F, Part I</a>            | ✓          | ✓        | 1A/AGG101          |
| Washed sieve                                      | <a href="#">Tex-200-F, Part II</a>           | ✓          | ✓        | 1A/AGG101          |
| Deleterious material                              | <a href="#">Tex-217-F, Parts I &amp; III</a> | ✓          | ✓        | AGG101             |
| Decantation                                       | <a href="#">Tex-217-F, Part II</a>           | ✓          | ✓        | AGG101             |
| Los Angeles abrasion                              | <a href="#">Tex-410-A</a>                    |            | ✓        | TxDOT              |
| Magnesium sulfate soundness                       | <a href="#">Tex-411-A</a>                    |            | ✓        | TxDOT              |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                    |            | ✓        | AGG101             |
| Crushed face count                                | <a href="#">Tex-460-A</a>                    | ✓          | ✓        | AGG101             |
| Flat and elongated particles                      | <a href="#">Tex-280-F</a>                    | ✓          | ✓        | AGG101             |
| Linear shrinkage                                  | <a href="#">Tex-107-E</a>                    | ✓          | ✓        | AGG101             |
| Sand equivalent                                   | <a href="#">Tex-203-F</a>                    | ✓          | ✓        | AGG101             |
| Bulk specific gravity                             | <a href="#">Tex-201-F</a>                    | ✓          | ✓        | AGG101             |
| Unit weight                                       | <a href="#">Tex-404-A</a>                    | ✓          | ✓        | AGG101             |
| Organic impurities                                | <a href="#">Tex-408-A</a>                    | ✓          | ✓        | AGG101             |
| <b>2. Asphalt Binder &amp; Tack Coat Sampling</b> |  |            |          |                    |
| Asphalt binder sampling                           | <a href="#">Tex-500-C, Part II</a>           | ✓          | ✓        | 1A/1B              |
| Tack coat sampling                                | <a href="#">Tex-500-C, Part III</a>          | ✓          | ✓        | 1A/1B              |
| <b>3. Mix Design &amp; Verification</b>           |  |            |          |                    |
| Design and JMF changes                            | <a href="#">Tex-204-F</a>                    | ✓          | ✓        | 2                  |
| Mixing  | <a href="#">Tex-205-F</a>                    | ✓          | ✓        | 2                  |
| Molding (SGC)                                     | <a href="#">Tex-241-F</a>                    | ✓          | ✓        | 1A                 |
| Laboratory-molded density                         | <a href="#">Tex-207-F, Parts I &amp; VI</a>  | ✓          | ✓        | 1A                 |
| Rice gravity                                      | <a href="#">Tex-227-F, Part II</a>           | ✓          | ✓        | 1A                 |
| Ignition oven correction factors <sup>2</sup>     | <a href="#">Tex-236-F, Part II</a>           | ✓          | ✓        | 2                  |
| Indirect tensile strength                         | <a href="#">Tex-226-F</a>                    | ✓          | ✓        | 1A                 |
| Hamburg Wheel test                                | <a href="#">Tex-242-F</a>                    | ✓          | ✓        | 1A                 |
| Boil test   | <a href="#">Tex-530-C</a>                    | ✓          | ✓        | 1A                 |
| <b>4. Production Testing</b>                      |  |            |          |                    |
| Selecting production random numbers               | <a href="#">Tex-225-F, Part I</a>            |            | ✓        | 1A                 |
| Mixture sampling                                  | <a href="#">Tex-222-F</a>                    | ✓          | ✓        | 1A/1B              |
| Molding (SGC)                                     | <a href="#">Tex-241-F</a>                    | ✓          | ✓        | 1A                 |
| Laboratory-molded density                         | <a href="#">Tex-207-F, Parts I &amp; VI</a>  | ✓          | ✓        | 1A                 |
| Rice gravity                                      | <a href="#">Tex-227-F, Part II</a>           | ✓          | ✓        | 1A                 |
| Gradation & asphalt binder content <sup>2</sup>   | <a href="#">Tex-236-F, Part I</a>            | ✓          | ✓        | 1A                 |
| Control charts                                    | <a href="#">Tex-233-F</a>                    | ✓          | ✓        | 1A                 |
| Moisture content                                  | <a href="#">Tex-212-F, Part II</a>           | ✓          | ✓        | 1A/AGG101          |
| Hamburg Wheel test                                | <a href="#">Tex-242-F</a>                    | ✓          | ✓        | 1A                 |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                    |            | ✓        | AGG101             |
| Boil test   | <a href="#">Tex-530-C</a>                    | ✓          | ✓        | 1A                 |
| Abson recovery                                    | <a href="#">Tex-211-F</a>                    |            | ✓        | TxDOT              |
| <b>5. Placement Testing</b>                       |  |            |          |                    |
| Selecting placement random numbers                | <a href="#">Tex-225-F, Part II</a>           |            | ✓        | 1B                 |
| Trimming roadway cores                            | <a href="#">Tex-251-F, Parts I &amp; II</a>  | ✓          | ✓        | 1A/1B              |
| In-place air voids                                | <a href="#">Tex-207-F, Parts I &amp; VI</a>  | ✓          | ✓        | 1A                 |
| In-place density (nuclear method)                 | <a href="#">Tex-207-F, Part III</a>          | ✓          |          | 1B                 |
| Establish rolling pattern                         | <a href="#">Tex-207-F, Part IV</a>           | ✓          |          | 1B                 |
| Control charts                                    | <a href="#">Tex-233-F</a>                    | ✓          | ✓        | 1A                 |
| Ride quality measurement                          | <a href="#">Tex-1001-S</a>                   | ✓          | ✓        | Note 3             |
| Segregation (density profile)                     | <a href="#">Tex-207-F, Part V</a>            | ✓          | ✓        | 1B                 |
| Longitudinal joint density                        | <a href="#">Tex-207-F, Part VII</a>          | ✓          | ✓        | 1B                 |
| Thermal profile                                   | <a href="#">Tex-244-F</a>                    | ✓          | ✓        | 1B                 |
| Shear Bond Strength Test                          | <a href="#">Tex-249-F</a>                    |            | ✓        | TxDOT              |

- Level 1A, 1B, AGG101, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.
- Refer to Section 3077.4.9.2.3., "Production Testing," for exceptions to using an ignition oven.
- Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.

4.2.

**Reporting and Responsibilities.** Use Department-provided templates to record and calculate all test data, including mixture design, production and placement QC/QA, control charts, thermal profiles, segregation density profiles, and longitudinal joint density. Obtain the current version of the templates at <http://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html> or from the Engineer. The Engineer and the Contractor will provide any available test results to the other party when requested. The maximum allowable time for the Contractor and Engineer to exchange test data is as given in Table 7 unless otherwise approved. The Engineer and the Contractor will immediately report to the other party any test result that requires suspension of production or placement, a payment adjustment less than 1.000, or that fails to meet the specification requirements. Record and electronically submit all test results and pertinent information on Department-provided templates.

Subsequent sublots placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Article 5.3., "Conformity with Plans, Specifications, and Special Provisions."

**Table 7  
Reporting Schedule**

| Description                             | Reported By | Reported To | To Be Reported Within  |
|---|-------------|-------------|--|
| <b>Production Quality Control</b>       |             |             |  |
| Gradation <sup>1</sup>                  | Contractor  | Engineer    | 1 working day of completion of the subplot   |
| Asphalt binder content <sup>1</sup>     |             |             |  |
| Laboratory-molded density <sup>2</sup>  |             |             |  |
| Moisture content <sup>3</sup>           |             |             |  |
| Boil test <sup>3</sup>                  |             |             |  |
| <b>Production Quality Assurance</b>     |             |             |  |
| Gradation <sup>3</sup>                  | Engineer    | Contractor  | 1 working day of completion of the subplot   |
| Asphalt binder content <sup>3</sup>     |             |             |  |
| Laboratory-molded density <sup>1</sup>  |             |             |  |
| Hamburg Wheel test <sup>4</sup>         |             |             |  |
| Boil test <sup>3</sup>                  |             |             |  |
| Binder tests <sup>4</sup>               |             |             |  |
| <b>Placement Quality Control</b>        |             |             |  |
| In-place air voids <sup>2</sup>         | Contractor  | Engineer    | 1 working day of completion of the lot   |
| Segregation <sup>1</sup>                |             |             |  |
| Longitudinal joint density <sup>1</sup> |             |             |  |
| Thermal profile <sup>1</sup>            |             |             |  |
| <b>Placement Quality Assurance</b>      |             |             |  |
| In-place air voids <sup>1</sup>         | Engineer    | Contractor  | 1 working day after receiving the trimmed cores <sup>5</sup>                       |
| Segregation <sup>3</sup>                |             |             | 1 working day of completion of the lot   |
| Longitudinal joint density <sup>3</sup> |             |             |  |
| Thermal profile <sup>3</sup>            |             |             |  |
| Aging ratio <sup>4</sup>                |             |             |  |
| Payment adjustment summary              | Engineer    | Contractor  | 2 working days of performing all required tests and receiving Contractor test data |

1. These tests are required on every subplot.
2. Optional test. When performed on split samples, report the results as soon as they become available.
3. To be performed at the frequency specified in Table 17 or as shown on the plans.
4. To be reported as soon as the results become available.
5. Two days are allowed if cores cannot be dried to constant weight within 1 day.

The Engineer will use the Department-provided template to calculate all payment adjustment factors for the lot. Sublot samples may be discarded after the Engineer and Contractor sign off on the payment adjustment summary documentation for the lot.

Use the procedures described in [Tex-233-F](#) to plot the results of all quality control (QC) and quality assurance (QA) testing. Update the control charts as soon as test results for each subplot become available.

Make the control charts readily accessible at the field laboratory. The Engineer may suspend production for failure to update control charts.

- 4.3. **Quality Control Plan (QCP).** Develop and follow the QCP in detail. Obtain approval for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Submit a written QCP before the mandatory pre-paving meeting. Receive approval of the QCP before beginning production. Include the following items in the QCP:

- 4.3.1. **Project Personnel.** For project personnel, include:
- a list of individuals responsible for QC with authority to take corrective action;
  - current contact information for each individual listed; and
  - current copies of certification documents for individuals performing specified QC functions.
- 4.3.2. **Material Delivery and Storage.** For material delivery and storage, include:
- the sequence of material processing, delivery, and minimum quantities to assure continuous plant operations;
  - aggregate stockpiling procedures to avoid contamination and segregation;
  - frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
  - procedure for monitoring the quality and variability of asphalt binder.
- 4.3.3. **Production.** For production, include:
- loader operation procedures to avoid contamination in cold bins;
  - procedures for calibrating and controlling cold feeds;
  - procedures to eliminate debris or oversized material;
  - procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, RAP, RAS, lime, liquid antistriper, WMA);
  - procedures for reporting job control test results; and
  - procedures to avoid segregation and drain-down in the silo.
- 4.3.4. **Loading and Transporting.** For loading and transporting, include:
- type and application method for release agents; and
  - truck loading procedures to avoid segregation.
- 4.3.5. **Placement and Compaction.** For placement and compaction, include:
- proposed agenda for mandatory pre-paving meeting, including date and location;
  - proposed paving plan (e.g., paving widths, joint offsets, and lift thicknesses);
  - type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
  - procedures for the transfer of mixture into the paver, while avoiding segregation and preventing material spillage;
  - process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality;
  - paver operations (e.g., operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
  - procedures to construct quality longitudinal and transverse joints.

#### 4.4. Mixture Design.

4.4.1. **Design Requirements.** Use the SP design procedure provided in [Tex-204-F](#), unless otherwise shown on the plans. Design the mixture to meet the requirements listed in Tables 1, 2, 3, 4, 5, 8, 9, 10, and 11.

Design the mixture at 50 gyrations (Ndesign). Use a target laboratory-molded density of 96.0% to design the mixture; however, adjustments can be made to the Ndesign value as noted in Table 10. The Ndesign level may be reduced to at least 35 gyrations at the Contractor's discretion.

Use an approved laboratory from the Department's MPL to perform the Hamburg Wheel test and provide results with the mixture design, or provide the laboratory mixture and request that the Department perform the Hamburg Wheel test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the laboratory mixture design.

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF1) before the Contractor can begin production.

The aggregate gradation may pass below or through the reference zone shown in Table 9 unless otherwise shown on the plans. Design a mixture with a gradation that has stone-on-stone contact and passes below the reference zone shown in Table 9 when shown on the plans. Verify stone-on-stone contact using the method given in the SP design procedure in [Tex-204-F](#), Part IV.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- asphalt binder content and aggregate gradation of RAP and RAS stockpiles;
- the Ndesign level used;
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

**Table 8**  
**Master Gradation Limits (% Passing by Weight or Volume) and VMA Requirements**

| Sieve Size  | SP-B Intermediate  | SP-C Surface       | SP-D Fine Mixture  |
|---|--------------------|--------------------|--------------------|
| 2"  | –                  | –                  | –                  |
| 1-1/2"  | 100.0 <sup>1</sup> | –                  | –                  |
| 1"  | 98.0–100.0         | 100.0 <sup>1</sup> | –                  |
| 3/4"  | 90.0–100.0         | 98.0–100.0         | 100.0 <sup>1</sup> |
| 1/2"  | Note <sup>2</sup>  | 90.0–100.0         | 98.0–100.0         |
| 3/8"  | –                  | Note <sup>2</sup>  | 90.0–100.0         |
| #4  | 23.0–90.0          | 28.0–90.0          | 32.0–90.0          |
| #8  | 23.0–34.6          | 28.0–37.0          | 32.0–40.0          |
| #16   | 2.0–28.3           | 2.0–31.6           | 2.0–37.6           |
| #30   | 2.0–20.7           | 2.0–23.1           | 2.0–27.5           |
| #50   | 2.0–13.7           | 2.0–15.5           | 2.0–18.7           |
| #200  | 2.0–8.0            | 2.0–10.0           | 2.0–10.0           |
| <b>Design VMA, % Minimum</b>                      |                    |                    |                    |
| –   | 14.0               | 15.0               | 16.0               |
| <b>Production (Plant-Produced) VMA, % Minimum</b> |                    |                    |                    |
| –   | 13.5               | 14.5               | 15.5               |

1. Defined as maximum sieve size. No tolerance allowed.
2. Must retain at least 10% cumulative.



**Table 9**  
**Reference Zones (% Passing by Weight or Volume)**

| Sieve Size | SP-B Intermediate | SP-C Surface | SP-D Fine Mixture |
|------------|-------------------|--------------|-------------------|
| 2"         | –                 | –            | –                 |
| 1-1/2"     | –                 | –            | –                 |
| 1"         | –                 | –            | –                 |
| 3/4"       | –                 | –            | –                 |
| 1/2"       | –                 | –            | –                 |
| 3/8"       | –                 | –            | –                 |
| #4         | –                 | –            | –                 |
| #8         | 34.6–34.6         | 39.1–39.1    | 47.2–47.2         |
| #16        | 22.3–28.3         | 25.6–31.6    | 31.6–37.6         |
| #30        | 16.7–20.7         | 19.1–23.1    | 23.5–27.5         |
| #50        | 13.7–13.7         | 15.5–15.5    | 18.7–18.7         |
| #200       | –                 | –            | –                 |

**Table 10**  
**Laboratory Mixture Design Properties**

| Mixture Property                       | Test Method               | Requirement         |
|--|---------------------------|---------------------|
| Target laboratory-molded density, %    | <a href="#">Tex-207-F</a> | 96.0                |
| Design gyrations (Ndesign)             | <a href="#">Tex-241-F</a> | 50 <sup>1</sup>     |
| Indirect tensile strength (dry), psi   | <a href="#">Tex-226-F</a> | 85–200 <sup>2</sup> |
| Dust/asphalt binder ratio <sup>3</sup> | –                         | 0.6–1.4             |
| Boil test <sup>4</sup>                 | <a href="#">Tex-530-C</a> | –                   |

- Adjust within a range of 35–100 gyrations when shown on the plans or specification or mutually agreed between the Engineer and Contractor.
- The Engineer may allow the IDT strength to exceed 200 psi if the corresponding Hamburg Wheel rut depth is greater than 3.0 mm and less than 12.5 mm.
- Defined as % passing #200 sieve divided by asphalt binder content.
- Used to establish baseline for comparison to production results. May be waived when approved.

**Table 11**  
**Hamburg Wheel Test Requirements**

| High-Temperature Binder Grade | Test Method               | Minimum # of Passes @ 12.5 mm <sup>1</sup> Rut Depth, Tested @ 50°C |
|-------------------------------|---------------------------|---|
| PG 64 or lower                | <a href="#">Tex-242-F</a> | 10,000 <sup>2</sup>   |
| PG 70                         |                           | 15,000 <sup>3</sup>   |
| PG 76 or higher               |                           | 20,000  |

- When the rut depth at the required minimum number of passes is less than 3 mm, the Engineer may require the Contractor to lower the Ndesign level to at least 35 gyrations.
- May be decreased to at least 5,000 passes when shown on the plans.
- May be decreased to at least 10,000 passes when shown on the plans.

4.4.2. **Job-Mix Formula Approval.** The job-mix formula (JMF) is the combined aggregate gradation, Ndesign level, and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When WMA is used, JMF1 may be designed and submitted to the Engineer without including the WMA additive. When WMA is used, document the additive or process used and recommended rate on the JMF1 submittal. The Engineer and the Contractor will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. The Department may require the Contractor to reimburse the Department for verification tests if more than two trial batches per design are required.

4.4.2.1. **Contractor's Responsibilities.**

4.4.2.1.1. **Providing Superpave Gyrotory Compactor (SGC).** Furnish an SGC calibrated in accordance with [Tex-241-F](#) for molding production samples. Locate the SGC at the Engineer's field laboratory and make the SGC available to the Engineer for use in molding production samples.

- 4.4.2.1.2. **Gyratory Compactor Correlation Factors.** Use [Tex-206-F](#), Part II, to perform a gyratory compactor correlation when the Engineer uses a different SGC. Apply the correlation factor to all subsequent production test results.
- 4.4.2.1.3. **Submitting JMF1.** Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide approximately 10,000 g of the design mixture if opting to have the Department perform the Hamburg Wheel test on the laboratory mixture, and request that the Department perform the test.
- 4.4.2.1.4. **Supplying Aggregates.** Provide approximately 40 lb. of each aggregate stockpile unless otherwise directed.
- 4.4.2.1.5. **Supplying Asphalt.** Provide at least 1 gal. of the asphalt material and enough quantities of any additives proposed for use.
- 4.4.2.1.6. **Ignition Oven Correction Factors.** Determine the aggregate and asphalt correction factors from the ignition oven in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 months old. Provide the Engineer with split samples of the mixtures before the trial batch production, including all additives (except water), and blank samples used to determine the correction factors for the ignition oven used for QA testing during production. Correction factors established from a previously approved mixture design may be used for the current mixture design if the mixture design and ignition oven are the same as previously used, unless otherwise directed.
- 4.4.2.1.7. **Boil Test.** Perform the test and retain the tested sample from [Tex-530-C](#) until completion of the project or as directed. Use this sample for comparison purposes during production. The Engineer may waive the requirement for the boil test.
- 4.4.2.1.8. **Trial Batch Production.** Provide a plant-produced trial batch upon receiving conditional approval of JMF1 and authorization to produce a trial batch, including the WMA additive or process if applicable, for verification testing of JMF1 and development of JMF2. Produce a trial batch mixture that meets the requirements in Table 4, Table 5, and Table 12. The Engineer may accept test results from recent production of the same mixture instead of a new trial batch.
- 4.4.2.1.9. **Trial Batch Production Equipment.** Use only equipment and materials proposed for use on the project to produce the trial batch.
- 4.4.2.1.10. **Trial Batch Quantity.** Produce enough quantity of the trial batch to ensure that the mixture meets the specification requirements.
- 4.4.2.1.11. **Number of Trial Batches.** Produce trial batches as necessary to obtain a mixture that meets the specification requirements.
- 4.4.2.1.12. **Trial Batch Sampling.** Obtain a representative sample of the trial batch and split it into 3 equal portions in accordance with [Tex-222-F](#). Label these portions as "Contractor," "Engineer," and "Referee." Deliver samples to the appropriate laboratory as directed.
- 4.4.2.1.13. **Trial Batch Testing.** Test the trial batch to ensure the mixture produced using the proposed JMF1 meets the mixture requirements in Table 12. Ensure the trial batch mixture is also in compliance with the Hamburg Wheel-requirement in Table 11. Use a Department-approved laboratory to perform the Hamburg Wheel test on the trial batch mixture or request that the Department perform the Hamburg Wheel test.
- The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the trial batch. Provide the Engineer with a copy of the trial batch test results.
- 4.4.2.1.14. **Development of JMF2.** Evaluate the trial batch test results after the Engineer grants full approval of JMF1 based on results from the trial batch, determine the optimum mixture proportions, and submit as JMF2.

Adjust the asphalt binder content or gradation to achieve the specified target laboratory-molded density. The asphalt binder content established for JMF2 is not required to be within any tolerance of the optimum asphalt binder content established for JMF1; however, mixture produced using JMF2 must meet the voids in mineral aggregates (VMA) requirements for production shown in Table 8. If the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1, the Engineer may perform or require the Contractor to perform [Tex-226-F](#) on Lot 1 production to confirm the indirect tensile strength does not exceed 200 psi. Verify that JMF2 meets the mixture requirements in Table 4 and Table 5.

- 4.4.2.1.15. **Mixture Production.** Use JMF2 to produce Lot 1 as described in Section 3077.4.9.3.1.1., “Lot 1 Placement,” after receiving approval for JMF2 and a passing result from the Department’s or a Department-approved laboratory’s Hamburg Wheel test on the trial batch. If desired, proceed to Lot 1 production, once JMF2 is approved, at the Contractor’s risk without receiving the results from the Department’s Hamburg Wheel test on the trial batch.

Notify the Engineer if electing to proceed without Hamburg Wheel test results from the trial batch. Note that the Engineer may require up to the entire subplot of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor’s expense.

- 4.4.2.1.16. **Development of JMF3.** Evaluate the test results from Lot 1, determine the optimum mixture proportions, and submit as JMF3 for use in Lot 2.

- 4.4.2.1.17. **JMF Adjustments.** If JMF adjustments are necessary to achieve the specified requirements, make the adjustment before beginning a new lot. The adjusted JMF must:

- be provided to the Engineer in writing before the start of a new lot;
- be numbered in sequence to the previous JMF;
- meet the mixture requirements in Table 4 and Table 5;
- meet the master gradation limits shown in Table 8; and
- be within the operational tolerances of JMF2 listed in Table 12.

- 4.4.2.1.18. **Requesting Referee Testing.** Use referee testing, if needed, in accordance with Section 3077.4.9.1., “Referee Testing,” to resolve testing differences with the Engineer.

**Table 12**  
**Operational Tolerances**

| Description   | Test Method  | Allowable Difference Between Trial Batch and JMF1 Target | Allowable Difference from Current JMF Target | Allowable Difference between Contractor and Engineer <sup>1</sup> |
|---|--|--|--|---|
| Individual % retained for #8 sieve and larger                         | <a href="#">Tex-200-F</a><br>or<br><a href="#">Tex-236-F</a> | Must be Within Master Grading Limits in Table 8          | ±5.0 <sup>2,3</sup>                          | ±5.0  |
| Individual % retained for sieves smaller than #8 and larger than #200 |  |  | ±3.0 <sup>2,3</sup>                          | ±3.0  |
| % passing the #200 sieve  |  |  | ±2.0 <sup>2,3</sup>                          | ±1.6  |
| Asphalt binder content, %   | <a href="#">Tex-236-F</a>                                    | ±0.5   | ±0.3 <sup>3</sup>                            | ±0.3  |
| Dust/asphalt binder ratio <sup>4</sup>                                | –  | Note 5   | Note 5                                       | N/A   |
| Laboratory-molded density, %  | <a href="#">Tex-207-F</a>                                    | ±1.0   | ±1.0   | ±0.5  |
| In-place air voids, %   |  | N/A  | N/A  | ±1.0  |
| Laboratory-molded bulk specific gravity                               |  | N/A  | N/A  | ±0.020  |
| VMA, % min  | <a href="#">Tex-204-F</a>                                    | Note 6   | Note 6                                       | N/A   |
| Theoretical maximum specific (Rice) gravity                           | <a href="#">Tex-227-F</a>                                    | N/A  | N/A  | ±0.020  |

- Contractor may request referee testing only when values exceed these tolerances.
- When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 will be considered out of tolerance when outside the master grading limits.
- Only applies to mixture produced for Lot 1 and higher.
- Defined as % passing #200 sieve divided by asphalt binder content.
- Verify that Table 10 requirement is met.
- Verify that Table 8 requirements are met.

#### 4.4.2.2. **Engineer's Responsibilities.**

4.4.2.2.1. **Gyratory Compactor.** The Engineer will use a Department SGC, calibrated in accordance with [Tex-241-F](#), to mold samples for laboratory mixture design verification. For molding trial batch and production specimens, the Engineer will use the Contractor-provided SGC at the field laboratory or provide and use a Department SGC at an alternate location. The Engineer will make the Contractor-provided SGC in the Department field laboratory available to the Contractor for molding verification samples.

4.4.2.2.2. **Conditional Approval of JMF1 and Authorizing Trial Batch.** The Engineer will review and verify conformance of the following information within two working days of receipt:

- the Contractor's mix design report (JMF1);
- the Contractor-provided Hamburg Wheel test results;
- all required materials including aggregates, asphalt, additives, and recycled materials; and
- the mixture specifications.

The Engineer will grant the Contractor conditional approval of JMF1 if the information provided on the paper copy of JMF1 indicates that the Contractor's mixture design meets the specifications. When the Contractor does not provide Hamburg Wheel test results with laboratory mixture design, 10 working days are allowed for conditional approval of JMF1. The Engineer will base full approval of JMF1 on the test results on mixture from the trial batch.

Unless waived, the Engineer will determine the Micro-Deval abrasion loss in accordance with Section 3077.2.1.1.2., "Micro-Deval Abrasion." If the Engineer's test results are pending after two working days, conditional approval of JMF1 will still be granted within 2 working days of receiving JMF1. When the Engineer's test results become available, they will be used for specification compliance.

After conditionally approving JMF1, including either Contractor- or Department-supplied Hamburg Wheel test results, the Contractor is authorized to produce a trial batch.

- 4.4.2.2.3. **Hamburg Wheel Testing of JMF1.** If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the laboratory mixture, the Engineer will mold samples in accordance with [Tex-242-F](#) to verify compliance with the Hamburg Wheel test requirement in Table 11.
- 4.4.2.2.4. **Ignition Oven Correction Factors.** The Engineer will use the split samples provided by the Contractor to determine the aggregate and asphalt correction factors for the ignition oven used for QA testing during production in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 months old.
- 4.4.2.2.5. **Testing the Trial Batch.** Within 1 full working day, the Engineer will sample and test the trial batch to ensure that the mixture meets the requirements in Table 12. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the trial batch mixture, the Engineer will mold samples in accordance with [Tex-242-F](#) to verify compliance with the Hamburg Wheel test requirement in Table 11.
- The Engineer will have the option to perform the following tests on the trial batch:
- [Tex-226-F](#), to verify that the indirect tensile strength meets the requirement shown in Table 10; and
  - [Tex-530-C](#), to retain and use for comparison purposes during production.
- 4.4.2.2.6. **Full Approval of JMF1.** The Engineer will grant full approval of JMF1 and authorize the Contractor to proceed with developing JMF2 if the Engineer's results for the trial batch meet the requirements in Table 12. The Engineer will notify the Contractor that an additional trial batch is required if the trial batch does not meet these requirements.
- 4.4.2.2.7. **Approval of JMF2.** The Engineer will approve JMF2 within one working day if the mixture meets the requirements in Table 5 and the gradation meets the master grading limits shown in Table 8. The asphalt binder content established for JMF2 is not required to be within any tolerance of the optimum asphalt binder content established for JMF1; however, mixture produced using JMF2 must meet the VMA requirements shown in Table 8. If the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1, the Engineer may perform or require the Contractor to perform [Tex-226-F](#) on Lot 1 production to confirm the indirect tensile strength does not exceed 200 psi.
- 4.4.2.2.8. **Approval of Lot 1 Production.** The Engineer will authorize the Contractor to proceed with Lot 1 production (using JMF2) as soon as a passing result is achieved from the Department's or a Department-approved laboratory's Hamburg Wheel test on the trial batch. The Contractor may proceed at its own risk with Lot 1 production without the results from the Hamburg Wheel test on the trial batch.
- If the Department's or Department-approved laboratory's sample from the trial batch fails the Hamburg Wheel test, the Engineer will suspend production until further Hamburg Wheel tests meet the specified values. The Engineer may require up to the entire subplot of any mixture failing the Hamburg Wheel test be removed and replaced at the Contractor's expense.
- 4.4.2.2.9. **Approval of JMF3 and Subsequent JMF Changes.** JMF3 and subsequent JMF changes are approved if they meet the mixture requirements shown in Table 4, Table 5, and the master grading limits shown in Table 8, and are within the operational tolerances of JMF2 shown in Table 12.
- 4.5. **Production Operations.** Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification. Submit a new mix design and perform a new trial batch when the asphalt binder content of:
- any RAP stockpile used in the mix is more than 0.5% higher than the value shown on the mixture design report; or
  - RAS stockpile used in the mix is more than 2.0% higher than the value shown on the mixture design report.

- 4.5.1. **Storage and Heating of Materials.** Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.
- 4.5.2. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed the maximum production temperatures listed in Table 13 (or 275°F for WMA). The Department will not pay for or allow placement of any mixture produced above the maximum production temperatures listed in Table 13.

**Table 13**  
**Maximum Production Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Maximum Production Temperature |
|--|--------------------------------|
| PG 64                                      | 325°F                          |
| PG 70                                      | 335°F                          |
| PG 76                                      | 345°F                          |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.

Produce WMA within the target discharge temperature range of 215°F and 275°F when WMA is required. Take corrective action any time the discharge temperature of the WMA exceeds the target discharge range. The Engineer may suspend production operations if the Contractor's corrective action is not successful at controlling the production temperature within the target discharge range. Note that when WMA is produced, it may be necessary to adjust burners to ensure complete combustion such that no burner fuel residue remains in the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. Determine the moisture content, if requested, by oven-drying in accordance with [Tex-212-F](#), Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck, and perform the test promptly.

- 4.6. **Hauling Operations.** Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent shown on the Department's MPL to coat the inside bed of the truck when necessary.

Use equipment for hauling as defined in Section 3077.4.7.3.3., "Hauling Equipment." Use other hauling equipment only when allowed.

- 4.7. **Placement Operations.** Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour or as directed. Use a hand-held thermal camera or infrared thermometer, when a thermal imaging system is not used, to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot-mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide with lane lines and are not placed in the wheel path, or as directed. Ensure that all finished surfaces will drain properly. Place the

mixture at the rate or thickness shown on the plans. The Engineer will use the guidelines in Table 14 to determine the compacted lift thickness of each layer when multiple lifts are required. The thickness determined is based on the rate of 110 lb./sq. yd. for each inch of pavement unless otherwise shown on the plans.

**Table 14**  
**Compacted Lift Thickness and Required Core Height**

| Mixture Type | Compacted Lift Thickness Guidelines |               | Minimum Untrimmed Core Height (in.) Eligible for Testing |
|--------------|-------------------------------------|---------------|--|
|              | Minimum (in.)                       | Maximum (in.) |  |
| SP-B         | 2.50                                | 4.0           | 2.00   |
| SP-C         | 2.00                                | 3.0           | 1.25   |
| SP-D         | 1.25                                | 2.0           | 1.25   |

4.7.1. **Weather Conditions.**

4.7.1.1. **When Using a Thermal Imaging System.** Place mixture when the roadway is dry and the roadway surface temperature is at or above the temperatures listed in Table 15A. The Engineer may restrict the Contractor from paving surface mixtures if the ambient temperature is likely to drop below 32°F within 12 hr. of paving. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. Provide output data from the thermal imaging system to demonstrate to the Engineer that no recurring severe thermal segregation exists in accordance with Section 3077.4.7.3.1.2., "Thermal Imaging System."

**Table 15A**  
**Minimum Pavement Surface Temperatures**

| High-Temperature Binder Grade <sup>1</sup> | Minimum Pavement Surface Temperatures (°F)   |  |
|--|--|--|
|  | Subsurface Layers or Night Paving Operations | Surface Layers Placed in Daylight Operations |
| PG 64                                      | 35   | 40   |
| PG 70                                      | 45 <sup>2</sup>                              | 50 <sup>2</sup>                              |
| PG 76                                      | 45 <sup>2</sup>                              | 50 <sup>2</sup>                              |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. Contractors may pave at temperatures 10°F lower than these values when a chemical WMA additive is used as a compaction aid in the mixture or when using WMA.

4.7.1.2. **When Not Using a Thermal Imaging System.** When using a thermal camera instead of the thermal imaging system, place mixture when the roadway surface temperature is at or above the temperatures listed in Table 15B unless otherwise approved or as shown on the plans. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. The Engineer may allow mixture placement to begin before the roadway surface reaches the required temperature if conditions are such that the roadway surface will reach the required temperature within 2 hr. of beginning placement operations. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the ambient temperature is likely to drop below 32°F within 12 hr. of paving.

**Table 15B**  
**Minimum Pavement Surface Temperatures**

| High-Temperature Binder Grade <sup>1</sup> | Minimum Pavement Surface Temperatures (°F)   |  |
|--|--|--|
|  | Subsurface Layers or Night Paving Operations | Surface Layers Placed in Daylight Operations |
| PG 64                                      | 45   | 50   |
| PG 70                                      | 55 <sup>2</sup>                              | 60 <sup>2</sup>                              |
| PG 76                                      | 60 <sup>2</sup>                              | 60 <sup>2</sup>                              |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. Contractors may pave at temperatures 10°F lower than these values when a chemical WMA additive is used as a compaction aid in the mixture, when using WMA, or utilizing a paving process with equipment that eliminates thermal segregation. In such cases, for each sublot and in the presence of the Engineer, use a hand-held thermal camera operated in accordance with [Tex-244-F](#) to demonstrate to the satisfaction of the Engineer that the uncompacted mat has no more than 10°F of thermal segregation.

#### 4.7.2. Tack Coat.

4.7.2.1. **Application.** Clean the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns. Apply the tack coat to all surfaces that will come in contact with the subsequent HMA placement, unless otherwise directed. Allow adequate time for emulsion to break completely before placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

4.7.2.2. **Sampling.** The Engineer will obtain at least one sample of the tack coat binder per project in accordance with [Tex-500-C](#), Part III, and test it to verify compliance with Item 300, "Asphalts, Oils, and Emulsions." The Engineer will notify the Contractor when the sampling will occur and will witness the collection of the sample from the asphalt distributor immediately before use.

For emulsions, the Engineer may test as often as necessary to ensure the residual of the emulsion is greater than or equal to the specification requirement in Item 300, "Asphalts, Oils, and Emulsions."

4.7.3. **Lay-Down Operations.** Use the placement temperatures in Table 16 to establish the minimum placement temperature of mixture delivered to the paver.

**Table 16**  
**Minimum Mixture Placement Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Minimum Placement Temperature (Before Entering Paver) <sup>2,3</sup> |
|--|--|
| PG 64                                      | 260°F  |
| PG 70                                      | 270°F  |
| PG 76                                      | 280°F  |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. Minimum placement temperatures may be reduced 10°F if using a chemical WMA additive as a compaction aid.
3. When using WMA, the minimum placement temperature is 215°F.

4.7.3.1. **Thermal Profile.** Use a hand-held thermal camera or a thermal imaging system to obtain a continuous thermal profile in accordance with [Tex-244-F](#). Thermal profiles are not applicable in areas described in Section 3077.4.9.3.1.4., "Miscellaneous Areas."

4.7.3.1.1. **Thermal Segregation.**



- 4.7.3.1.1.1. **Moderate.** Any areas that have a temperature differential greater than 25°F, but not exceeding 50°F, are deemed as moderate thermal segregation.
- 4.7.3.1.1.2. **Severe.** Any areas that have a temperature differential greater than 50°F are deemed as severe thermal segregation.
- 4.7.3.1.2. **Thermal Imaging System.** Review the output results when a thermal imaging system is used, and provide the automated report described in [Tex-244-F](#) to the Engineer daily unless otherwise directed. Modify the paving process as necessary to eliminate any recurring (moderate or severe) thermal segregation identified by the thermal imaging system. The Engineer may suspend paving operations if the Contractor cannot successfully modify the paving process to eliminate recurring severe thermal segregation. Density profiles are not required and not applicable when using a thermal imaging system. Provide the Engineer with electronic copies of all daily data files that can be used with the thermal imaging system software to generate temperature profile plots daily or upon completion of the project or as requested by the Engineer.
- 4.7.3.1.3. **Thermal Camera.** When using a thermal camera instead of the thermal imaging system, take immediate corrective action to eliminate recurring moderate thermal segregation when a hand-held thermal camera is used. Evaluate areas with moderate thermal segregation by performing density profiles in accordance with Section 3077.4.9.3.3.2., "Segregation (Density Profile)." Provide the Engineer with the thermal profile of every subplot within one working day of the completion of each lot. When requested by the Engineer, provide the thermal images generated using the thermal camera. Report the results of each thermal profile in accordance with Section 3077.4.2., "Reporting and Responsibilities." The Engineer will use a hand-held thermal camera to obtain a thermal profile at least once per project. No production or placement payment adjustments greater than 1.000 will be paid for any subplot that contains severe thermal segregation. Suspend operations and take immediate corrective action to eliminate severe thermal segregation unless otherwise directed. Resume operations when the Engineer determines that subsequent production will meet the requirements of this Section. Evaluate areas with severe thermal segregation by performing density profiles in accordance with Section 3077.4.9.3.3.2., "Segregation (Density Profile)." Remove and replace the material in any areas that have both severe thermal segregation and a failing result for Segregation (Density Profile) unless otherwise directed. The subplot in question may receive a production and placement payment adjustment greater than 1.000, if applicable, when the defective material is successfully removed and replaced.
- 4.7.3.2. **Windrow Operations.** Operate windrow pickup equipment so that when hot-mix is placed in windrows, substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.
- 4.7.3.3. **Hauling Equipment.** Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture; however, with exception of paving miscellaneous areas, end dump trucks are only allowed when used in conjunction with an MTD with remixing capability or when a thermal imaging system is used unless otherwise allowed.
- 4.7.3.4. **Screed Heaters.** Turn off screed heaters to prevent overheating of the mat if the paver stops for more than 5 min. The Engineer may evaluate the suspect area in accordance with Section 3077.4.9.3.3.4., "Recovered Asphalt Dynamic Shear Rheometer (DSR)," if the screed heater remains on for more than 5 min. while the paver is stopped.
- 4.8. **Compaction.** Compact the pavement uniformly to contain between 3.7% and 7.5% in-place air voids. Take immediate corrective action to bring the operation within 3.7% and 7.5% when the in-place air voids exceed the range of these tolerances. The Engineer will allow paving to resume when the proposed corrective action is likely to yield between 3.7% and 7.5% in-place air voids.

Obtain cores in areas placed under Exempt Production, as directed, at locations determined by the Engineer. The Engineer may test these cores and suspend operations or require removal and replacement if the in-place air voids are less than 2.7% or more than 9.0%. Areas defined in Section 3077.4.9.3.1.4., "Miscellaneous Areas," are not subject to in-place air void determination.

Furnish the type, size, and number of rollers required for compaction as approved. Use additional rollers as required to remove any roller marks. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.

Use the control strip method shown in [Tex-207-F](#), Part IV, on the first day of production to establish the rolling pattern that will produce the desired in-place air voids unless otherwise directed.

Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

Complete all compaction operations before the pavement temperature drops below 160°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 160°F.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

- 4.9. **Acceptance Plan.** Payment adjustments for the material will be in accordance with Article 3077.6., "Payment."

Sample and test the hot-mix on a lot and subplot basis. Suspend production until test results or other information indicates to the satisfaction of the Engineer that the next material produced or placed will result in pay factors of at least 1.000 if the production pay factor given in Section 3077.6.1., "Production Payment Adjustment Factors," for two consecutive lots or the placement pay factor given in Section 3077.6.2., "Placement Payment Adjustment Factors," for two consecutive lots is below 1.000.

- 4.9.1. **Referee Testing.** The Materials and Tests Division is the referee laboratory. The Contractor may request referee testing if a "remove and replace" condition is determined based on the Engineer's test results, or if the differences between Contractor and Engineer test results exceed the maximum allowable difference shown in Table 12 and the differences cannot be resolved. The Contractor may also request referee testing if the Engineer's test results require suspension of production and the Contractor's test results are within specification limits. Make the request within 5 working days after receiving test results and cores from the Engineer. Referee tests will be performed only on the subplot in question and only for the particular tests in question. Allow 10 working days from the time the referee laboratory receives the samples for test results to be reported. The Department may require the Contractor to reimburse the Department for referee tests if more than three referee tests per project are required and the Engineer's test results are closer to the referee test results than the Contractor's test results.

The Materials and Tests Division will determine the laboratory-molded density based on the molded specific gravity and the maximum theoretical specific gravity of the referee sample. The in-place air voids will be determined based on the bulk specific gravity of the cores, as determined by the referee laboratory and the Engineer's average maximum theoretical specific gravity for the lot. With the exception of "remove and replace" conditions, referee test results are final and will establish payment adjustment factors for the subplot in question. The Contractor may decline referee testing and accept the Engineer's test results when the placement payment adjustment factor for any subplot results in a "remove and replace" condition. Placement sublots subject to be removed and replaced will be further evaluated in accordance with Section 3077.6.2.2., "Placement Sublots Subject to Removal and Replacement."

- 4.9.2. **Production Acceptance.**

- 4.9.2.1. **Production Lot.** A production lot consists of four equal sublots. The default quantity for Lot 1 is 1,000 tons; however, when requested by the Contractor, the Engineer may increase the quantity for Lot 1 to no more than 4,000 tons. The Engineer will select subsequent lot sizes based on the anticipated daily production such

that approximately three to four sublots are produced each day. The lot size will be between 1,000 tons and 4,000 tons. The Engineer may change the lot size before the Contractor begins any lot.

If the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1, the Engineer may perform or require the Contractor to perform [Tex-226-F](#) on Lot 1 to confirm the indirect tensile strength does not exceed 200 psi. Take corrective action to bring the mixture within specification compliance if the indirect tensile strength exceeds 200 psi unless otherwise directed.

- 4.9.2.1.1. **Incomplete Production Lots.** If a lot is begun but cannot be completed, such as on the last day of production or in other circumstances deemed appropriate, the Engineer may close the lot. Adjust the payment for the incomplete lot in accordance with Section 3077.6.1., "Production Payment Adjustment Factors." Close all lots within five working days unless otherwise allowed.
- 4.9.2.2. **Production Sampling.**
- 4.9.2.2.1. **Mixture Sampling.** Obtain hot-mix samples from trucks at the plant in accordance with [Tex-222-F](#). The sampler will split each sample into three equal portions in accordance with [Tex-200-F](#) and label these portions as "Contractor," "Engineer," and "Referee." The Engineer will perform or witness the sample splitting and take immediate possession of the samples labeled "Engineer" and "Referee." The Engineer will maintain the custody of the samples labeled "Engineer" and "Referee" until the Department's testing is completed.
- 4.9.2.2.1.1. **Random Sample.** At the beginning of the project, the Engineer will select random numbers for all production sublots. Determine sample locations in accordance with [Tex-225-F](#). Take one sample for each subplot at the randomly selected location. The Engineer will perform or witness the sampling of production sublots.
- 4.9.2.2.1.2. **Blind Sample.** For one subplot per lot, the Engineer will obtain and test a "blind" sample instead of the random sample collected by the Contractor. Test either the "blind" or the random sample; however, referee testing (if applicable) will be based on a comparison of results from the "blind" sample. The location of the Engineer's "blind" sample will not be disclosed to the Contractor. The Engineer's "blind" sample may be randomly selected in accordance with [Tex-225-F](#) for any subplot or selected at the discretion of the Engineer. The Engineer will use the Contractor's split sample for sublots not sampled by the Engineer.
- 4.9.2.2.2. **Informational Shear Bond Strength Testing.** Select one random subplot from Lot 2 or higher for shear bond strength testing. Obtain full depth cores in accordance with [Tex-249-F](#). Label the cores with the Control Section Job (CSJ), producer of the tack coat, mix type, shot rate, lot, and subplot number and provide to the Engineer. The Engineer will ship the cores to the Materials and Tests Division or district laboratory for shear bond strength testing. Results from these tests will not be used for specification compliance.
- 4.9.2.2.3. **Asphalt Binder Sampling.** Obtain a 1-qt. sample of the asphalt binder witnessed by the Engineer for each lot of mixture produced. The Contractor will notify the Engineer when the sampling will occur. Obtain the sample at approximately the same time the mixture random sample is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill and upstream from the introduction of any additives in accordance with [Tex-500-C](#), Part II. Label the can with the corresponding lot and subplot numbers, producer, producer facility location, grade, district, date sampled, and project information including highway and CSJ. The Engineer will retain these samples for one year. The Engineer may also obtain independent samples. If obtaining an independent asphalt binder sample and upon request of the Contractor, the Engineer will split a sample of the asphalt binder with the Contractor.
- At least once per project, the Engineer will collect split samples of each binder grade and source used. The Engineer will submit one split sample to MTD to verify compliance with Item 300, "Asphalts, Oils, and Emulsions" and will retain the other split sample for one year.
- 4.9.2.3. **Production Testing.** The Contractor and Engineer must perform production tests in accordance with Table 17. The Contractor has the option to verify the Engineer's test results on split samples provided by the Engineer. Determine compliance with operational tolerances listed in Table 12 for all sublots.

Take immediate corrective action if the Engineer's laboratory-molded density on any subplot is less than 95.0% or greater than 97.0% to bring the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

The Engineer may allow alternate methods for determining the asphalt binder content and aggregate gradation if the aggregate mineralogy is such that [Tex-236-F](#), Part I does not yield reliable results. Provide evidence that results from [Tex-236-F](#), Part I are not reliable before requesting permission to use an alternate method unless otherwise directed. Use the applicable test procedure as directed if an alternate test method is allowed.

**Table 17**  
**Production and Placement Testing Frequency**

| Description   | Test Method  | Minimum Contractor Testing Frequency | Minimum Engineer Testing Frequency |
|---|--|--------------------------------------|------------------------------------|
| Individual % retained for #8 sieve and larger                         | <a href="#">Tex-200-F</a><br>or<br><a href="#">Tex-236-F</a> | 1 per subplot                        | 1 per 12 sublots <sup>1</sup>      |
| Individual % retained for sieves smaller than #8 and larger than #200 |  |                                      |                                    |
| % passing the #200 sieve  |  |                                      |                                    |
| Laboratory-molded density   | <a href="#">Tex-207-F</a>                                    | N/A                                  | 1 per subplot <sup>1</sup>         |
| Laboratory-molded bulk specific gravity                               |  |                                      |                                    |
| In-place air voids  |  |                                      |                                    |
| VMA   | <a href="#">Tex-204-F</a>                                    |                                      |                                    |
| Segregation (density profile)   | <a href="#">Tex-207-F</a> , Part V                           | 1 per subplot <sup>2</sup>           | 1 per project                      |
| Longitudinal joint density  | <a href="#">Tex-207-F</a> , Part VII                         |                                      |                                    |
| Moisture content  | <a href="#">Tex-212-F</a> , Part II                          | When directed                        |                                    |
| Theoretical maximum specific (Rice) gravity                           | <a href="#">Tex-227-F</a>                                    | N/A                                  | 1 per subplot <sup>1</sup>         |
| Asphalt binder content  | <a href="#">Tex-236-F</a>                                    | 1 per subplot                        | 1 per lot <sup>1</sup>             |
| Hamburg Wheel test  | <a href="#">Tex-242-F</a>                                    | N/A                                  | 1 per project                      |
| Recycled Asphalt Shingles (RAS) <sup>3</sup>                          | <a href="#">Tex-217-F</a> , Part III                         | N/A                                  |                                    |
| Thermal profile   | <a href="#">Tex-244-F</a>                                    | 1 per subplot <sup>2</sup>           |                                    |
| Asphalt binder sampling and testing                                   | <a href="#">Tex-500-C</a> , Part II                          | 1 per lot (sample only) <sup>4</sup> |                                    |
| Tack coat sampling and testing  | <a href="#">Tex-500-C</a> , Part III                         | N/A                                  |                                    |
| Boil test <sup>5</sup>  | <a href="#">Tex-530-C</a>                                    | 1 per lot                            |                                    |
| Shear Bond Strength Test <sup>6</sup>                                 | <a href="#">Tex-249-F</a>                                    | 1 per project (sample only)          |                                    |

- For production defined in Section 3077.4.9.4., "Exempt Production," the Engineer will test one per day if 100 tons or more are produced. For Exempt Production, no testing is required when less than 100 tons are produced.
- To be performed in the presence of the Engineer, unless otherwise approved. Not required when a thermal imaging system is used.
- Testing performed by the Materials and Tests Division or designated laboratory.
- Obtain samples witnessed by the Engineer. The Engineer will retain these samples for one year.
- The Engineer may reduce or waive the sampling and testing requirements based on a satisfactory test history.
- Testing performed by the Materials and Tests Division or District for informational purposes only.

4.9.2.4. **Operational Tolerances.** Control the production process within the operational tolerances listed in Table 12. When production is suspended, the Engineer will allow production to resume when test results or other information indicates the next mixture produced will be within the operational tolerances.

4.9.2.4.1. **Gradation.** Suspend operation and take corrective action if any aggregate is retained on the maximum sieve size shown in Table 8. A subplot is defined as out of tolerance if either the Engineer's or the Contractor's test results are out of operational tolerance. Suspend production when test results for gradation exceed the operational tolerances in Table 12 for three consecutive sublots on the same sieve or four consecutive sublots on any sieve unless otherwise directed. The consecutive sublots may be from more than one lot.

4.9.2.4.2. **Asphalt Binder Content.** A subplot is defined as out of operational tolerance if either the Engineer's or the Contractor's test results exceed the values listed in Table 12. No production or placement payment

adjustments greater than 1.000 will be paid for any subplot that is out of operational tolerance for asphalt binder content. Suspend production and shipment of the mixture if the Engineer's or the Contractor's asphalt binder content deviates from the current JMF by more than 0.5% for any subplot.

- 4.9.2.4.3. **Voids in Mineral Aggregates (VMA).** The Engineer will determine the VMA for every subplot. For sublots when the Engineer does not determine asphalt binder content, the Engineer will use the asphalt binder content results from QC testing performed by the Contractor to determine VMA.

Take immediate corrective action if the VMA value for any subplot is less than the minimum VMA requirement for production listed in Table 8. Suspend production and shipment of the mixture if the Engineer's VMA results on two consecutive sublots are below the minimum VMA requirement for production listed in Table 8. No production or placement payment adjustments greater than 1.000 will be paid for any subplot that does not meet the minimum VMA requirement for production listed in Table 8 based on the Engineer's VMA determination.

Suspend production and shipment of the mixture if the Engineer's VMA result is more than 0.5% below the minimum VMA requirement for production listed in Table 8. In addition to suspending production, the Engineer may require removal and replacement or may allow the subplot to be left in place without payment.

- 4.9.2.4.4. **Hamburg Wheel Test.** The Engineer may perform a Hamburg Wheel test at any time during production, including when the boil test indicates a change in quality from the materials submitted for JMF 1. In addition to testing production samples, the Engineer may obtain cores and perform Hamburg Wheel tests on any areas of the roadway where rutting is observed. Suspend production until further Hamburg Wheel tests meet the specified values when the production or core samples fail the Hamburg Wheel test criteria in Table 11. Core samples, if taken, will be obtained from the center of the finished mat or other areas excluding the vehicle wheel paths. The Engineer may require up to the entire subplot of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor's expense.

If the Department's or Department approved laboratory's Hamburg Wheel test results in a "remove and replace" condition, the Contractor may request that the Department confirm the results by re-testing the failing material. The Materials and Tests Division will perform the Hamburg Wheel tests and determine the final disposition of the material in question based on the Department's test results.

- 4.9.2.5. **Individual Loads of Hot-Mix.** The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances shown in Table 12, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.

#### 4.9.3. **Placement Acceptance.**

- 4.9.3.1. **Placement Lot.** A placement lot consists of four placement sublots. A placement subplot consists of the area placed during a production subplot.

- 4.9.3.1.1. **Lot 1 Placement.** Placement payment adjustments greater than 1.000 for Lot 1 will be in accordance with Section 3077.6.2., "Placement Payment Adjustment Factors;" however, no placement adjustment less than 1.000 will be assessed for any subplot placed in Lot 1 when the in-place air voids are greater than or equal to 2.7% and less than or equal to 9.0%. Remove and replace any subplot with in-place air voids less than 2.7% or greater than 9.0%.

- 4.9.3.1.2. **Incomplete Placement Lots.** An incomplete placement lot consists of the area placed as described in Section 3077.4.9.2.1.1., "Incomplete Production Lot," excluding areas defined in Section 3077.4.9.3.1.4., "Miscellaneous Areas." Placement sampling is required if the random sample plan for production resulted in a sample being obtained from an incomplete production subplot.

- 4.9.3.1.3. **Shoulders, Ramps, Etc.** Shoulders, ramps, intersections, acceleration lanes, deceleration lanes, and turn lanes are subject to in-place air void determination and payment adjustments unless designated on the plans as not eligible for in-place air void determination. Intersections may be considered miscellaneous areas when determined by the Engineer.
- 4.9.3.1.4. **Miscellaneous Areas.** Miscellaneous areas include areas that typically involve significant handwork or discontinuous paving operations, such as temporary detours, driveways, mailbox turnouts, crossovers, gores, spot level-up areas, and other similar areas. Temporary detours are subject to in-place air void determination when shown on the plans. Miscellaneous areas also include level-ups and thin overlays when the layer thickness specified on the plans is less than the minimum untrimmed core height eligible for testing shown in Table 14. The specified layer thickness is based on the rate of 110 lb./sq. yd. for each inch of pavement unless another rate is shown on the plans. When "level up" is listed as part of the item bid description code, a payment adjustment factor of 1.000 will be assigned for all placement sublots as described in Article 3077.6, "Payment." Miscellaneous areas are not eligible for random placement sampling locations. Compact miscellaneous areas in accordance with Section 3077.4.8., "Compaction." Miscellaneous areas are not subject to in-place air void determination, thermal profiles testing, segregation (density profiles), or longitudinal joint density evaluations.
- 4.9.3.2. **Placement Sampling.** The Engineer will select random numbers for all placement sublots at the beginning of the project. The Engineer will provide the Contractor with the placement random numbers immediately after the subplot is completed. Mark the roadway location at the completion of each subplot and record the station number. Determine one random sample location for each placement subplot in accordance with [Tex-225-F](#). Adjust the random sample location by no more than necessary to achieve a 2-ft. clearance if the location is within 2 ft. of a joint or pavement edge.

Shoulders, ramps, intersections, acceleration lanes, deceleration lanes, and turn lanes are always eligible for selection as a random sample location; however, if a random sample location falls on one of these areas and the area is designated on the plans as not subject to in-place air void determination, cores will not be taken for the subplot and a 1.000 pay factor will be assigned to that subplot.

Provide the equipment and means to obtain and trim roadway cores on-site. On-site is defined as in close proximity to where the cores are taken. Obtain the cores within one working day of the time the placement subplot is completed unless otherwise approved. Obtain two 6-in. diameter cores side-by-side from within 1 ft. of the random location provided for the placement subplot. For SP-C and SP-D mixtures, 4-in. diameter cores are allowed. Mark the cores for identification, measure and record the untrimmed core height, and provide the information to the Engineer. The Engineer will witness the coring operation and measurement of the core thickness. Visually inspect each core and verify that the current paving layer is bonded to the underlying layer. Take corrective action if an adequate bond does not exist between the current and underlying layer to ensure that an adequate bond will be achieved during subsequent placement operations.

Trim the cores immediately after obtaining the cores from the roadway in accordance with [Tex-251-F](#) if the core heights meet the minimum untrimmed value listed in Table 14. Trim the cores on-site in the presence of the Engineer. Use a permanent marker or paint pen to record the lot and subplot numbers on each core as well as the designation as Core A or B. The Engineer may require additional information to be marked on the core and may choose to sign or initial the core. The Engineer will take custody of the cores immediately after witnessing the trimming of the cores and will retain custody of the cores until the Department's testing is completed. Before turning the trimmed cores over to the Engineer, the Contractor may wrap the trimmed cores or secure them in a manner that will reduce the risk of possible damage occurring during transport by the Engineer. After testing, the Engineer will return the cores to the Contractor.

The Engineer may have the cores transported back to the Department's laboratory at the HMA plant via the Contractor's haul truck or other designated vehicle. In such cases where the cores will be out of the Engineer's possession during transport, the Engineer will use Department-provided security bags and the Roadway Core Custody protocol located at <http://www.txdot.gov/business/specifications.htm> to provide a secure means and process that protects the integrity of the cores during transport.

Decide whether to include the pair of cores in the air void determination for that subplot if the core height before trimming is less than the minimum untrimmed value shown in Table 14. Trim the cores as described above before delivering to the Engineer if electing to have the cores included in the air void determination. Deliver untrimmed cores to the Engineer and inform the Engineer of the decision to not have the cores included in air void determination if electing to not have the cores included in air void determination. The placement pay factor for the subplot will be 1.000 if cores will not be included in air void determination.

Instead of the Contractor trimming the cores on-site immediately after coring, the Engineer and the Contractor may mutually agree to have the trimming operations performed at an alternate location such as a field laboratory or other similar location. In such cases, the Engineer will take possession of the cores immediately after they are obtained from the roadway and will retain custody of the cores until testing is completed. Either the Department or Contractor representative may perform trimming of the cores. The Engineer will witness all trimming operations in cases where the Contractor representative performs the trimming operation.

Dry the core holes and tack the sides and bottom immediately after obtaining the cores. Fill the hole with the same type of mixture and properly compact the mixture. Repair core holes with other methods when approved.

4.9.3.3. **Placement Testing.** Perform placement tests in accordance with Table 17. After the Engineer returns the cores, the Contractor may test the cores to verify the Engineer's test results for in-place air voids. The allowable differences between the Contractor's and Engineer's test results are listed in Table 12.

4.9.3.3.1. **In-Place Air Voids.** The Engineer will measure in-place air voids in accordance with [Tex-207-F](#) and [Tex-227-F](#). Before drying to a constant weight, cores may be pre-dried using a CoreDry or similar vacuum device to remove excess moisture. The Engineer will average the values obtained for all sublots in the production lot to determine the theoretical maximum specific gravity. The Engineer will use the average air void content for in-place air voids.

The Engineer will use the vacuum method to seal the core if required by [Tex-207-F](#). The Engineer will use the test results from the unsealed core to determine the placement payment adjustment factor if the sealed core yields a higher specific gravity than the unsealed core. After determining the in-place air void content, the Engineer will return the cores and provide test results to the Contractor.

4.9.3.3.2. **Segregation (Density Profile).** Test for segregation using density profiles in accordance with [Tex-207-F](#), Part V when using a thermal camera instead of the thermal imaging system. Density profiles are not required and are not applicable when using a thermal imaging system. Density profiles are not applicable in areas described in Section 3077.4.9.3.1.4., "Miscellaneous Areas."

Perform a minimum of one density profile per subplot. Perform additional density profiles when any of the following conditions occur, unless otherwise approved:

- the paver stops due to lack of material being delivered to the paving operations and the temperature of the uncompacted mat before the initial break down rolling is less than the temperatures shown in Table 18;
- areas that are identified by either the Contractor or the Engineer with thermal segregation;
- any visibly segregated areas that exist.

**Table 18**  
**Minimum Uncompacted Mat Temperature Requiring a Segregation Profile**

| <b>High-Temperature Binder Grade<sup>1</sup></b> | <b>Minimum Temperature of the Uncompacted Mat Allowed Before Initial Break Down Rolling<sup>2,3,4</sup></b> |
|--|---|
| PG 64  | <250°F  |
| PG 70  | <260°F  |
| PG 76  | <270°F  |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. Segregation profiles are required in areas with moderate and severe thermal segregation as described in Section 3077.4.7.3.1.3.
3. Minimum uncompacted mat temperature requiring a segregation profile may be reduced 10°F if using a chemical WMA additive as a compaction aid.
4. When using WMA, the minimum uncompacted mat temperature requiring a segregation profile is 215°F.

Provide the Engineer with the density profile of every subplot in the lot within one working day of the completion of each lot. Report the results of each density profile in accordance with Section 3077.4.2., "Reporting and Responsibilities."

The density profile is considered failing if it exceeds the tolerances in Table 19. No production or placement payment adjustments greater than 1.000 will be paid for any subplot that contains a failing density profile. When a hand-held thermal camera is used instead of a thermal imaging system, the Engineer will measure the density profile at least once per project. The Engineer's density profile results will be used when available. The Engineer may require the Contractor to remove and replace the area in question if the area fails the density profile and has surface irregularities as defined in Section 3077.4.9.3.3.5., "Irregularities." The subplot in question may receive a production and placement payment adjustment greater than 1.000, if applicable, when the defective material is successfully removed and replaced.

Investigate density profile failures and take corrective actions during production and placement to eliminate the segregation. Suspend production if two consecutive density profiles fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

**Table 19**  
**Segregation (Density Profile) Acceptance Criteria**

| <b>Mixture Type</b> | <b>Maximum Allowable Density Range (Highest to Lowest)</b> | <b>Maximum Allowable Density Range (Average to Lowest)</b> |
|---------------------|--|--|
| SP-B                | 8.0 pcf  | 5.0 pcf  |
| SP-C & SP-D         | 6.0 pcf  | 3.0 pcf  |

#### 4.9.3.3.3. Longitudinal Joint Density.

4.9.3.3.3.1. **Informational Tests.** Perform joint density evaluations while establishing the rolling pattern and verify that the joint density is no more than 3.0 pcf below the density taken at or near the center of the mat. Adjust the rolling pattern, if needed, to achieve the desired joint density. Perform additional joint density evaluations at least once per subplot unless otherwise directed.

4.9.3.3.3.2. **Record Tests.** Perform a joint density evaluation for each subplot at each pavement edge that is or will become a longitudinal joint. Joint density evaluations are not applicable in areas described in Section 3077.4.9.3.1.4., "Miscellaneous Areas." Determine the joint density in accordance with [Tex-207-F](#), Part VII. Record the joint density information and submit results on Department forms to the Engineer. The evaluation is considered failing if the joint density is more than 3.0 pcf below the density taken at the core random sample location and the correlated joint density is less than 90.0%. The Engineer will make independent joint density verification at least once per project and may make independent joint density



verifications at the random sample locations. The Engineer's joint density test results will be used when available.

Provide the Engineer with the joint density of every subplot in the lot within one working day of the completion of each lot. Report the results of each joint density in accordance with Section 3077.4.2., "Reporting and Responsibilities."

Investigate joint density failures and take corrective actions during production and placement to improve the joint density. Suspend production if the evaluations on two consecutive sublots fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

4.9.3.3.4. **Recovered Asphalt Dynamic Shear Rheometer (DSR).** The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Materials and Tests Division. The aging ratio is the DSR value of the extracted binder divided by the DSR value of the original unaged binder. Obtain DSR values in accordance with AASHTO T 315 at the specified high temperature performance grade of the asphalt. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores in accordance with [Tex-211-F](#).

4.9.3.3.5. **Irregularities.** Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. If the Engineer determines that the irregularity will adversely affect pavement performance, the Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities. The Engineer may also require the Contractor to remove and replace (at the Contractor's expense) areas where the mixture does not bond to the existing pavement.

If irregularities are detected, the Engineer may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.

4.9.4. **Exempt Production.** The Engineer may deem the mixture as exempt production for the following conditions:

- anticipated daily production is less than 500 tons;
- total production for the project is less than 5,000 tons;
- when mutually agreed between the Engineer and the Contractor; or
- when shown on the plans.

For exempt production, the Contractor is relieved of all production and placement QC/QA sampling and testing requirements, except for coring operations when required by the Engineer. The production and placement pay factors are 1.000 if the specification requirements listed below are met, all other specification requirements are met, and the Engineer performs acceptance tests for production and placement listed in Table 17 when 100 tons or more per day are produced:

- produce, haul, place, and compact the mixture in compliance with the specification and as directed;
- control mixture production to yield a laboratory-molded density that is within  $\pm 1.0\%$  of the target laboratory-molded density as tested by the Engineer;
- compact the mixture in accordance with Section 3077.4.8., "Compaction"; and
- when a thermal imaging system is not used, the Engineer may perform segregation (density profiles) and thermal profiles in accordance with the specification.

4.9.5. **Ride Quality.** Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

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## 5. MEASUREMENT

- 5.1. **Superpave Mixtures.** Hot mix will be measured by the ton of composite hot-mix, which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."
- 5.2. **Tack Coat.** Tack coat will be measured at the applied temperature by strapping the tank before and after road application and determining the net volume in gallons from the calibrated distributor. The Engineer will witness all strapping operations for volume determination. All tack, including emulsions, will be measure by the gallon applied.

The Engineer may allow the use of a metering device to determine the asphalt volume used and application rate if the device is accurate within 1.5% of the strapped volume.

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## 6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under Article 3077.5.1, "Measurement," will be paid for at the unit bid price for "Superpave Mixtures" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, materials, placement, equipment, labor, tools, and incidentals.

The work performed and materials furnished in accordance with this Item and measured as provided under Article 3077.5.2, "Measurement," will be paid for at the unit bid price for "Tack Coat" of the tack coat provided. These prices are full compensation for materials, placement, equipment, labor, tools, and incidentals. Payment adjustments will be applied as determined in this Item; however, a payment adjustment factor of 1.000 will be assigned for all placement sublots for "level ups" only when "level up" is listed as part of the item bid description code. A payment adjustment factor of 1.000 will be assigned to all production and placement sublots when "exempt" is listed as part of the item bid description code, and all testing requirements are met.

Payment for each subplot, including applicable payment adjustments greater than 1.000, will only be paid for sublots when the Contractor supplies the Engineer with the required documentation for production and placement QC/QA, thermal profiles, segregation density profiles, and longitudinal joint densities in accordance with Section 3077.4.2., "Reporting and Responsibilities." When a thermal imaging system is used, documentation is not required for thermal profiles or segregation density profiles on individual sublots; however, the thermal imaging system automated reports described in [Tex-244-F](#) are required.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."

- 6.1. **Production Payment Adjustment Factors.** The production payment adjustment factor is based on the laboratory-molded density using the Engineer's test results. The bulk specific gravities of the samples from each subplot will be divided by the Engineer's maximum theoretical specific gravity for the subplot. The individual sample densities for the subplot will be averaged to determine the production payment adjustment factor in accordance with Table 20 for each subplot using the deviation from the target laboratory-molded density defined in Table 10. The production payment adjustment factor for completed lots will be the average of the payment adjustment factors for the four sublots sampled within that lot.

**Table 20**  
**Production Payment Adjustment Factors for Laboratory-Molded Density<sup>1</sup>**

| Absolute Deviation from<br>Target Laboratory-Molded Density | Production Payment Adjustment Factor<br>(Target Laboratory-Molded Density) |
|---|--|
| 0.0   | 1.075  |
| 0.1   | 1.075  |
| 0.2   | 1.075  |
| 0.3   | 1.066  |
| 0.4   | 1.057  |
| 0.5   | 1.047  |
| 0.6   | 1.038  |
| 0.7   | 1.029  |
| 0.8   | 1.019  |
| 0.9   | 1.010  |
| 1.0   | 1.000  |
| 1.1   | 0.900  |
| 1.2   | 0.800  |
| 1.3   | 0.700  |
| > 1.3   | Remove and replace   |

1. If the Engineer's laboratory-molded density on any subplot is less than 95.0% or greater than 97.0%, take immediate corrective action to bring the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

- 6.1.1. **Payment for Incomplete Production Lots.** Production payment adjustments for incomplete lots, described under Section 3077.4.9.2.1.1., "Incomplete Production Lots," will be calculated using the average production pay factors from all sublots sampled.

A production payment factor of 1.000 will be assigned to any lot when the random sampling plan did not result in collection of any samples within the first subplot.

- 6.1.2. **Production Sublots Subject to Removal and Replacement.** If after referee testing, the laboratory-molded density for any subplot results in a "remove and replace" condition as listed in Table 20, the Engineer may require removal and replacement or may allow the subplot to be left in place without payment. The Engineer may also accept the subplot in accordance with Section 3077.5.3.1., "Acceptance of Defective or Unauthorized Work." Replacement material meeting the requirements of this Item will be paid for in accordance with this Section.

- 6.2. **Placement Payment Adjustment Factors.** The placement payment adjustment factor is based on in-place air voids using the Engineer's test results. The bulk specific gravities of the cores from each subplot will be divided by the Engineer's average maximum theoretical specific gravity for the lot. The individual core densities for the subplot will be averaged to determine the placement payment adjustment factor in accordance with Table 21 for each subplot that requires in-place air void measurement. A placement payment adjustment factor of 1.000 will be assigned to the entire subplot when the random sample location falls in an area designated on the plans as not subject to in-place air void determination. A placement payment adjustment factor of 1.000 will be assigned to quantities placed in areas described in Section 3077.4.9.3.1.4., "Miscellaneous Areas." The placement payment adjustment factor for completed lots will be the average of the placement payment adjustment factors for up to four sublots within that lot.

**Table 21**  
**Placement Payment Adjustment Factors for In-Place Air Voids**

| <b>In-Place Air Voids</b> | <b>Placement Payment Adjustment Factor</b> | <b>In-Place Air Voids</b> | <b>Placement Payment Adjustment Factor</b> |
|---------------------------|--|---------------------------|--|
| < 2.7                     | Remove and Replace                         | 5.9                       | 1.048                                      |
| 2.7                       | 0.710                                      | 6.0                       | 1.045                                      |
| 2.8                       | 0.740                                      | 6.1                       | 1.042                                      |
| 2.9                       | 0.770                                      | 6.2                       | 1.039                                      |
| 3.0                       | 0.800                                      | 6.3                       | 1.036                                      |
| 3.1                       | 0.830                                      | 6.4                       | 1.033                                      |
| 3.2                       | 0.860                                      | 6.5                       | 1.030                                      |
| 3.3                       | 0.890                                      | 6.6                       | 1.027                                      |
| 3.4                       | 0.920                                      | 6.7                       | 1.024                                      |
| 3.5                       | 0.950                                      | 6.8                       | 1.021                                      |
| 3.6                       | 0.980                                      | 6.9                       | 1.018                                      |
| 3.7                       | 1.000                                      | 7.0                       | 1.015                                      |
| 3.8                       | 1.015                                      | 7.1                       | 1.012                                      |
| 3.9                       | 1.030                                      | 7.2                       | 1.009                                      |
| 4.0                       | 1.045                                      | 7.3                       | 1.006                                      |
| 4.1                       | 1.060                                      | 7.4                       | 1.003                                      |
| 4.2                       | 1.075                                      | 7.5                       | 1.000                                      |
| 4.3                       | 1.075                                      | 7.6                       | 0.980                                      |
| 4.4                       | 1.075                                      | 7.7                       | 0.960                                      |
| 4.5                       | 1.075                                      | 7.8                       | 0.940                                      |
| 4.6                       | 1.075                                      | 7.9                       | 0.920                                      |
| 4.7                       | 1.075                                      | 8.0                       | 0.900                                      |
| 4.8                       | 1.075                                      | 8.1                       | 0.880                                      |
| 4.9                       | 1.075                                      | 8.2                       | 0.860                                      |
| 5.0                       | 1.075                                      | 8.3                       | 0.840                                      |
| 5.1                       | 1.072                                      | 8.4                       | 0.820                                      |
| 5.2                       | 1.069                                      | 8.5                       | 0.800                                      |
| 5.3                       | 1.066                                      | 8.6                       | 0.780                                      |
| 5.4                       | 1.063                                      | 8.7                       | 0.760                                      |
| 5.5                       | 1.060                                      | 8.8                       | 0.740                                      |
| 5.6                       | 1.057                                      | 8.9                       | 0.720                                      |
| 5.7                       | 1.054                                      | 9.0                       | 0.700                                      |
| 5.8                       | 1.051                                      | > 9.0                     | Remove and Replace                         |

- 6.2.1. **Payment for Incomplete Placement Lots.** Payment adjustments for incomplete placement lots described under Section 3077.4.9.3.1.2., "Incomplete Placement Lots," will be calculated using the average of the placement pay factors from all sublots sampled and sublots where the random location falls in an area designated on the plans as not eligible for in-place air void determination.

If the random sampling plan results in production samples, but not in placement samples, the random core location and placement adjustment factor for the subplot will be determined by applying the placement random number to the length of the subplot placed.

If the random sampling plan results in placement samples, but not in production samples, no placement adjustment factor will apply for that subplot placed.

A placement payment adjustment factor of 1.000 will be assigned to any lot when the random sampling plan did not result in collection of any production samples.

- 6.2.2. **Placement Sublots Subject to Removal and Replacement.** If after referee testing, the placement payment adjustment factor for any subplot results in a "remove and replace" condition as listed in Table 21, the Engineer will choose the location of two cores to be taken within 3 ft. of the original failing core location. The Contractor will obtain the cores in the presence of the Engineer. The Engineer will take immediate possession of the untrimmed cores and submit the untrimmed cores to the Materials and Tests Division,

where they will be trimmed, if necessary, and tested for bulk specific gravity within 10 working days of receipt.

The bulk specific gravity of the cores from each subplot will be divided by the Engineer's average maximum theoretical specific gravity for the lot. The individual core densities for the subplot will be averaged to determine the new payment adjustment factor of the subplot in question. If the new payment adjustment factor is 0.700 or greater, the new payment adjustment factor will apply to that subplot. If the new payment adjustment factor is less than 0.700, no payment will be made for the subplot. Remove and replace the failing subplot, or the Engineer may allow the subplot to be left in place without payment. The Engineer may also accept the subplot in accordance with Section 3077.5.3.1., "Acceptance of Defective or Unauthorized Work." Replacement material meeting the requirements of this Item will be paid for in accordance with this Section.

- 6.3. **Total Adjusted Pay Calculation.** Total adjusted pay (TAP) will be based on the applicable payment adjustment factors for production and placement for each lot.

$$TAP = (A+B)/2$$

where:

*A* = Bid price × production lot quantity × average payment adjustment factor for the production lot

*B* = Bid price × placement lot quantity × average payment adjustment factor for the placement lot + (bid price × quantity placed in miscellaneous areas × 1.000)

*Production lot quantity* = Quantity actually placed - quantity left in place without payment

*Placement lot quantity* = Quantity actually placed - quantity left in place without payment - quantity placed in miscellaneous areas

# Special Specification 3079

## Permeable Friction Course



### 1. DESCRIPTION

Construct a hot-mix asphalt (HMA) surface course composed of a compacted permeable mixture of aggregate, asphalt binder, and additives mixed hot in a mixing plant.

### 2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

- 2.1. **Aggregate.** Furnish aggregates from sources that conform to the requirements in accordance with Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse aggregate. Do not use intermediate or fine aggregate in permeable friction course (PFC) mixtures. Supply aggregates that meet the definitions in [Tex-100-E](#) for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests in accordance with Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in [Tex-200-F](#), Part II.

- 2.1.1. **Coarse Aggregate.** Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance;
- approved only when tested by the Engineer;
- once approved, do not add material to the stockpile unless otherwise approved; and
- allow 30 calendar days for the Engineer to sample, test, and report results.

Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes, unless otherwise shown on the plans. SAC requirements apply to aggregates used on surfaces other than travel lanes when shown on the plans. The SAC for sources on the Department's *Aggregate Quality Monitoring Program* (AQMP) ([Tex-499-A](#)) is listed in the BRSQC.

2.1.1.1. **Blending Class A and Class B Aggregates.** To prevent crushing of the Class B aggregate when blending, Class B aggregate may be blended with a Class A aggregate to meet requirements for Class A materials if the Department's BRSQC rated source soundness magnesium (RSSM) rating for the Class B aggregate is less than the Class A aggregate or if the RSSM rating for the Class B aggregate is less than or equal to 10%. Use the rated values for hot mix asphaltic concrete (HMAC) published in the BRSQC. When blending Class A and B aggregates to meet a Class A requirement, ensure that at least 50% by weight, or volume if required, of all the aggregates used in the mixture design retained on the No. 4 sieve comes from the Class A aggregate source, unless otherwise shown on the plans. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. Class B aggregate may be disallowed when shown on the plans.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 4 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

2.1.1.2. **Micro-Deval Abrasion.** The Engineer will perform a minimum of one Micro-Deval abrasion test in accordance with [Tex-461-A](#) for each coarse aggregate source used in the mixture design that has a Rated Source Soundness Magnesium (RSSM) loss value greater than 10 as listed in the BRSQC, unless otherwise directed. The Engineer will perform testing before the start of production and may perform additional testing at any time during production. The Engineer may obtain the coarse aggregate samples from each coarse aggregate source or may require the Contractor to obtain the samples. The Engineer may waive all Micro-Deval testing based on a satisfactory test history of the same aggregate source.

The Engineer will estimate the magnesium sulfate soundness loss for each coarse aggregate source, when tested, using the following formula:

$$Mg_{est.} = (RSSM)(MD_{act.}/RSMD)$$

where:

$Mg_{est.}$  = magnesium sulfate soundness loss

RSSM = Rated Source Soundness Magnesium

$MD_{act.}$  = actual Micro-Deval percent loss

RSMD = Rated Source Micro-Deval

When the estimated magnesium sulfate soundness loss is greater than the maximum magnesium sulfate soundness loss specified, the coarse aggregate source will not be allowed for use unless otherwise approved. The Engineer will consult the Soils and Aggregates Section of the Materials and Tests Division, and additional testing may be required before granting approval.

**Table 1**  
**Coarse Aggregate Quality Requirements**

| Property                                      | Test Method                         | Requirement           |
|---|-------------------------------------|-----------------------|
| SAC   | <a href="#">Tex-499-A</a> (AQMP)    | As shown on the plans |
| Deleterious material, %, Max                  | <a href="#">Tex-217-F</a> , Part I  | 1.0                   |
| Decantation, %, Max                           | <a href="#">Tex-217-F</a> , Part II | 1.5                   |
| Micro-Deval abrasion, %                       | <a href="#">Tex-461-A</a>           | Note <sup>1</sup>     |
| Los Angeles abrasion, %, Max                  | <a href="#">Tex-410-A</a>           | 30                    |
| Magnesium sulfate soundness, 5 cycles, %, Max | <a href="#">Tex-411-A</a>           | 20                    |
| Crushed face count, <sup>2</sup> %, Min       | <a href="#">Tex-460-A</a> , Part I  | 95                    |
| Flat and elongated particles @ 5:1, %, Max    | <a href="#">Tex-280-F</a>           | 10                    |

1. Used to estimate the magnesium sulfate soundness loss in accordance with Section 3079.2.1.1.2., "Micro-Deval Abrasion."

2. Only applies to crushed gravel.

- 2.2. **Baghouse Fines.** Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.
- 2.3. **Asphalt Binder.** Furnish the type and grade of binder specified on the plans that meets the requirements of Item 300, "Asphalts, Oils, and Emulsions."
- 2.3.1. **Performance-Graded (PG) Binder.** Provide an asphalt binder with a high-temperature grade of PG 76 and low-temperature grade as shown on the plans in accordance with Section 300.2.10., "Performance-Graded Binders," when PG binder is specified.
- 2.3.2. **Asphalt-Rubber (A-R) Binder.** Provide A-R binder that meets the Type I or Type II requirements of Section 300.2.9., "Asphalt-Rubber Binders," when A-R is specified unless otherwise shown on the plans. Use at least 15.0% by weight of Crumb Rubber Modifier (CRM) that meets the Grade B or Grade C requirements of Section 300.2.7., "Crumb Rubber Modifier," unless otherwise shown on the plans. Provide the Engineer the A-R binder blend design with the mix design (JMF1) submittal. Provide the Engineer with documentation such as the bill of lading showing the quantity of CRM used in the project unless otherwise directed.
- 2.4. **Tack Coat.** Furnish CSS-1H, SS-1H, EBL, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, "Asphalts, Oils, and Emulsions." Specialized tack coat materials listed on the Department's Tracking Resistant Asphalt Interlayer (TRAIL) MPL may be allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.
- 2.5. **Additives.** Provide the Engineer with documentation such as the bill of lading showing the quantity of additives used in the project unless otherwise directed.
- 2.5.1. **Fibers.** Provide cellulose or mineral fibers when PG binder is specified. Do not use fibers when A-R binder is specified. Submit written certification to the Engineer that the fibers proposed for use meet the requirements of DMS-9204, "Fiber Additives for Bituminous Mixtures." Fibers may be pre-blended into the binder at the asphalt supply terminal unless otherwise shown on the plans.
- 2.5.2. **Lime Mineral Filler.** Add lime as mineral filler at a rate of 1.0% by weight of the total dry aggregate in accordance with Item 301, "Asphalt Antistripping Agents," unless otherwise shown on the plans or waived by the Engineer based on Hamburg Wheel test results. Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.
- 2.5.3. **Lime and Liquid Antistripping Agent.** When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum. When the plans require lime to be added as an antistripping agent, lime added as mineral filler will count towards the total quantity of lime specified.
- 2.5.4. **Compaction Aid.** Compaction aid is defined as a Department-approved chemical warm mix additive denoted as "chemical additive" on the Department's materials producer list (MPL) that is used to facilitate mixing and compaction of HMA.
- Compaction aid is allowed for use on all projects. Compaction aid is required when shown on the plans or as required in Section 3079.4.7.1., "Weather Conditions."
- Warm mix foaming processes, denoted as "foaming process" on the Department-approved MPL, may be used to facilitate mixing and compaction of HMA; however warm mix foaming processes are not defined as a Compaction aid.
- 2.6. **Recycled Materials.** Recycled materials are not allowed for use.



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**3. EQUIPMENT**

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement." When A-R binder is specified, equip the hot-mix plant with an in-line viscosity-measuring device located between the blending unit and the mixing drum. Provide a means to calibrate the asphalt mass flow meter on-site when a meter is used.

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**4. CONSTRUCTION**

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a mandatory pre-paving meeting with the Engineer on or before the first day of paving unless otherwise shown on the plans.

- 4.1. **Certification.** Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 2. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist. Provide Level 1A certified specialists at the plant during production operations. Provide Level 1B certified specialists to conduct placement tests. Provide Level AGG101 certified specialists for aggregate testing.

**Table 2**  
**Test Methods, Test Responsibility, and Minimum Certification Levels**

| Test Description                                  | Test Method  | Contractor | Engineer | Level <sup>1</sup> |
|---|--|------------|----------|--------------------|
| <b>1. Aggregate Testing</b>                       |  |            |          |                    |
| Sampling  | <a href="#">Tex-221-F</a>                          | ✓          | ✓        | 1A/AGG101          |
| Dry sieve   | <a href="#">Tex-200-F, Part I</a>                  | ✓          | ✓        | 1A/AGG101          |
| Washed sieve                                      | <a href="#">Tex-200-F, Part II</a>                 | ✓          | ✓        | 1A/AGG101          |
| Deleterious material                              | <a href="#">Tex-217-F, Parts I &amp; III</a>       | ✓          | ✓        | AGG101             |
| Decantation                                       | <a href="#">Tex-217-F, Part II</a>                 | ✓          | ✓        | AGG101             |
| Los Angeles abrasion                              | <a href="#">Tex-410-A</a>                          |            | ✓        | Department         |
| Magnesium sulfate soundness                       | <a href="#">Tex-411-A</a>                          |            | ✓        | Department         |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                          |            | ✓        | AGG101             |
| Crushed face count                                | <a href="#">Tex-460-A</a>                          | ✓          | ✓        | AGG101             |
| Flat and elongated particles                      | <a href="#">Tex-280-F</a>                          | ✓          | ✓        | AGG101             |
| <b>2. Asphalt Binder &amp; Tack Coat Sampling</b> |  |            |          |                    |
| Asphalt binder sampling                           | <a href="#">Tex-500-C, Part II</a>                 | ✓          | ✓        | 1A/1B              |
| Tack coat sampling                                | <a href="#">Tex-500-C, Part III</a>                | ✓          | ✓        | 1A/1B              |
| <b>3. Mix Design &amp; Verification</b>           |  |            |          |                    |
| Design and JMF changes                            | <a href="#">Tex-204-F</a>                          | ✓          | ✓        | 2                  |
| Mixing  | <a href="#">Tex-205-F</a>                          | ✓          | ✓        | 2                  |
| Molding (SGC)                                     | <a href="#">Tex-241-F</a>                          | ✓          | ✓        | 1A                 |
| Laboratory-molded density                         | <a href="#">Tex-207-F, Parts I, VI, &amp; VIII</a> | ✓          | ✓        | 1A                 |
| Rice gravity                                      | <a href="#">Tex-227-F, Part II</a>                 | ✓          | ✓        | 1A                 |
| Ignition oven correction factors <sup>2</sup>     | <a href="#">Tex-236-F, Part II</a>                 | ✓          | ✓        | 2                  |
| Drain-down  | <a href="#">Tex-235-F</a>                          | ✓          | ✓        | 1A                 |
| Hamburg Wheel test                                | <a href="#">Tex-242-F</a>                          | ✓          | ✓        | 1A                 |
| Boil test <sup>4</sup>                            | <a href="#">Tex-530-C</a>                          | ✓          | ✓        | 1A                 |
| Cantabro loss                                     | <a href="#">Tex-245-F</a>                          | ✓          | ✓        | 1A                 |
| <b>4. Production Testing</b>                      |  |            |          |                    |
| Control charts                                    | <a href="#">Tex-233-F</a>                          | ✓          | ✓        | 1A                 |
| Mixture sampling                                  | <a href="#">Tex-222-F</a>                          | ✓          | ✓        | 1A/1B              |
| Gradation & asphalt binder content <sup>2</sup>   | <a href="#">Tex-236-F, Part I</a>                  | ✓          | ✓        | 1A                 |
| Moisture content                                  | <a href="#">Tex-212-F, Part II</a>                 | ✓          | ✓        | 1A/AGG101          |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                          |            | ✓        | AGG101             |
| Drain-down  | <a href="#">Tex-235-F</a>                          | ✓          | ✓        | 1A                 |
| Boil test <sup>4</sup>                            | <a href="#">Tex-530-C</a>                          | ✓          | ✓        | 1A                 |
| Abson recovery                                    | <a href="#">Tex-211-F</a>                          |            | ✓        | Department         |
| <b>5. Placement Testing</b>                       |  |            |          |                    |
| Control charts                                    | <a href="#">Tex-233-F</a>                          | ✓          | ✓        | 1A                 |
| Ride quality measurement                          | <a href="#">Tex-1001-S</a>                         | ✓          | ✓        | Note 3             |
| Thermal profile                                   | <a href="#">Tex-244-F</a>                          | ✓          | ✓        | 1B                 |
| Water flow test                                   | <a href="#">Tex-246-F</a>                          | ✓          | ✓        | 1B                 |
| Shear bond strength test                          | <a href="#">Tex-249-F</a>                          |            | ✓        | Department         |

- Level 1A, 1B, AGG101, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.
- Refer to Section 3079.4.9.2.3., "Production Testing," for exceptions to using an ignition oven.
- Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.
- When shown on the plans.

- 4.2. **Reporting and Responsibilities.** Use Department-provided templates to record and calculate all test data, including mixture design, production and placement tests, control charts, and thermal profiles. Obtain the current version of the templates at <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html> or from the Engineer. The Engineer and the Contractor will provide any available test results to the other party when requested. The maximum allowable time for the Contractor and Engineer to exchange test data is given in Table 3. The Engineer and the Contractor will immediately report to the other party any test result that requires suspension of production or placement or that fails to meet the specification requirements. Record and electronically submit all test results and pertinent information on Department-provided templates.

Subsequent sublots placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Article 5.3., "Conformity with Plans, Specifications, and Special Provisions."

**Table 3**  
**Reporting Schedule**

| Description                            | Reported By | Reported To | To Be Reported Within                      |
|--|-------------|-------------|--|
| <b>Production Quality Control</b>      |             |             |  |
| Gradation <sup>1</sup>                 | Contractor  | Engineer    | 1 working day of completion of the subplot |
| Asphalt binder content <sup>1</sup>    |             |             |  |
| Laboratory-molded density <sup>1</sup> |             |             |  |
| Moisture content <sup>2</sup>          |             |             |  |
| Drain-down <sup>1</sup>                |             |             |  |
| Boil test <sup>4</sup>                 |             |             |  |
| <b>Production Quality Assurance</b>    |             |             |  |
| Gradation <sup>2</sup>                 | Engineer    | Contractor  | 1 working day of completion of the subplot |
| Asphalt binder content <sup>2</sup>    |             |             |  |
| Laboratory-molded density <sup>2</sup> |             |             |  |
| Hamburg Wheel test <sup>3</sup>        |             |             |  |
| Boil test <sup>4</sup>                 |             |             |  |
| Drain-down <sup>2</sup>                |             |             |  |
| Binder tests <sup>3</sup>              |             |             |  |
| <b>Placement Quality Control</b>       |             |             |  |
| Thermal profile <sup>1</sup>           | Contractor  | Engineer    | 1 working day of completion of the lot     |
| Water flow <sup>1</sup>                |             |             |  |
| <b>Placement Quality Assurance</b>     |             |             |  |
| Thermal profile <sup>2</sup>           | Engineer    | Contractor  | 1 working day of completion of the lot     |
| Aging ratio <sup>3</sup>               |             |             |  |
| Water flow <sup>2</sup>                |             |             |  |

1. These tests are required on every subplot.
2. To be performed at the frequency in accordance with Table 9 or as shown on the plans.
3. To be reported as soon as the results become available.
4. When shown on the plans

Use the procedures described in [Tex-233-F](#) to plot the results of all production and placement testing, when directed. Update the control charts as soon as test results for each subplot become available. Make the control charts readily accessible at the field laboratory. The Engineer may suspend production for failure to update control charts.

- 4.3. **Quality Control Plan (QCP).** Develop and follow the QCP in detail. Obtain approval for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Submit a written QCP before the mandatory pre-paving meeting when directed. Receive approval of the QCP before pre-paving meeting. Include the following items in the QCP:

- 4.3.1. **Project Personnel.** For project personnel, include:
- a list of individuals responsible for QC with authority to take corrective action;
  - current contact information for each individual listed; and

- current copies of certification documents for individuals performing specified QC functions.

4.3.2. **Material Delivery and Storage.** For material delivery and storage, include:

- the sequence of material processing, delivery, and minimum quantities to assure continuous plant operations;
- aggregate stockpiling procedures to avoid contamination and segregation;
- frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
- procedure for monitoring the quality and variability of asphalt binder.

4.3.3. **Production.** For production, include:

- loader operation procedures to avoid contamination in cold bins;
- procedures for calibrating and controlling cold feeds;
- procedures to eliminate debris or oversized material;
- procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, lime, liquid antistriper, compaction aid, foaming process, fibers);
- procedures for reporting job control test results; and
- procedures to avoid segregation and drain-down in the silo.

4.3.4. **Loading and Transporting.** For loading and transporting, include:

- type and application method for release agents; and
- truck loading procedures to avoid segregation.

4.3.5. **Placement and Compaction.** For placement and compaction, include:

- proposed agenda for mandatory pre-paving meeting, including date and location;
- proposed paving plan (e.g., production rate, paving widths, joint offsets, and lift thicknesses);
- type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
- procedures for the transfer of mixture into the paver, while avoiding physical and thermal segregation and preventing material spillage;
- process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality;
- paver operations (e.g., speed, operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
- procedures to construct quality longitudinal and transverse joints.

4.4. **Mixture Design.**

4.4.1. **Design Requirements.** Use the PFC design procedure provided in [Tex-204-E](#), unless otherwise shown on the plans. Design the mixture to meet the requirements in accordance with Tables 1, 4, 5, and 6. Use a Superpave Gyrotory Compactor (SGC) at 50 gyrations as the design number of gyrations (Ndesign).

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF1) before the Contractor can begin production.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;

- the date the mixture design was performed; and
- a unique identification number for the mixture design.

**Table 4**  
**Master Gradation Limits (% Passing by Weight or Volume)**

| Sieve Size | PG 76 Mixtures     |                    | A-R Mixtures       |                    | Test Procedure            |
|------------|--------------------|--------------------|--------------------|--------------------|---------------------------|
|            | Fine (PFC-F)       | Coarse (PFC-C)     | Fine (PFCR-F)      | Coarse (PFCR-C)    |                           |
| 3/4"       | –                  | 100.0 <sup>1</sup> | 100.0 <sup>1</sup> | 100.0 <sup>1</sup> | <a href="#">Tex-200-F</a> |
| 1/2"       | 100.0 <sup>1</sup> | 80.0–100.0         | 95.0–100.0         | 80.0–100.0         |                           |
| 3/8"       | 95.0–100.0         | 35.0–60.0          | 50.0–80.0          | 35.0–60.0          |                           |
| #4         | 20.0–55.0          | 1.0–20.0           | 0.0–8.0            | 0.0–20.0           |                           |
| #8         | 1.0–10.0           | 1.0–10.0           | 0.0–4.0            | 0.0–10.0           |                           |
| #200       | 1.0–4.0            | 1.0–4.0            | 0.0–4.0            | 0.0–4.0            |                           |

1. Defined as maximum sieve size. No tolerance allowed.

**Table 5**  
**Mixture Design Properties**

| Mix Property   | PG 76 Mixtures            |                             | A-R Mixtures               |                              | Test Procedure            |
|--|---------------------------|-----------------------------|----------------------------|------------------------------|---------------------------|
|  | Fine (PFC-F) Requirements | Coarse (PFC-C) Requirements | Fine (PFCR-F) Requirements | Coarse (PFCR-C) Requirements |                           |
| Design gyrations (N <sub>design</sub> )                      | 50                        | 50                          | 50                         | 50                           | <a href="#">Tex-241-F</a> |
| Lab-molded density, %  | 78.0 Max                  | 82.0 Max                    | 82.0 Max                   | 82.0 Max                     | <a href="#">Tex-207-F</a> |
| Asphalt Binder Content, %                                    | 6.0–7.0                   | 6.0–7.0                     | 8.0–10.0                   | 7.0–9.0                      | --                        |
| Hamburg Wheel test, <sup>1</sup> passes at 12.5 mm rut depth | 10,000 Min <sup>2</sup>   | Note 3                      | Note 3                     | Note 3                       | <a href="#">Tex-242-F</a> |
| Drain-down, %  | 0.10 Max                  | 0.10 Max                    | 0.10 Max                   | 0.10 Max                     | <a href="#">Tex-235-F</a> |
| Fiber content, % by wt. of total PG 76 mixture               | 0.20–0.50                 | 0.20–0.50                   | –                          | –                            | Calculated                |
| Lime content, % by wt. of total aggregate                    | 1.0 <sup>4</sup>          | 1.0 <sup>4</sup>            | –                          | –                            | Calculated                |
| CRM content, % by wt. of A-R binder                          | –                         | –                           | 15.0 Min                   | 15.0 Min                     | Calculated                |
| Boil test <sup>5</sup>                                       | –                         | –                           | –                          | –                            | <a href="#">Tex-530-C</a> |
| Cantabro loss, %   | 20.0 Max                  | 20.0 Max                    | 20.0 Max                   | 20.0 Max                     | <a href="#">Tex-245-F</a> |

1. Mold test specimens to N<sub>design</sub> at the optimum asphalt binder content.
2. May be decreased when shown on the plans.
3. No specification value is required unless otherwise shown on the plans.
4. Unless otherwise shown on the plans or waived by the Engineer based on Hamburg Wheel results.
5. When shown on the plans. Used to establish baseline for comparison to production results.

4.4.2. **Job-Mix Formula Approval.** The job-mix formula (JMF) is the combined aggregate gradation, N<sub>design</sub> level, and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When a compaction aid or foaming process is used, JMF1 may be designed and submitted to the Engineer without including the compaction aid or foaming process. When a compaction aid or foaming process is used, document the compaction aid or foaming process used and recommended rate on the JMF1 submittal. The Engineer and the Contractor will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. The Department may require the Contractor to reimburse the Department for verification tests if more than two trial batches per design are required.

4.4.2.1. **Contractor's Responsibilities.**

- 4.4.2.1.1. **Providing Gyrotory Compactor.** Furnish an SGC calibrated in accordance with [Tex-241-F](#) for molding production samples. Locate the SGC at the Engineer's field laboratory or make the SGC available to the Engineer for use in molding production samples.
- 4.4.2.1.2. **Gyrotory Compactor Correlation Factors.** Use [Tex-206-F](#), Part II, to perform a gyrotory compactor correlation when the Engineer uses a different SGC. Apply the correlation factor to all subsequent production test results.
- 4.4.2.1.3. **Submitting JMF1.** Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide an additional 25 lb. of the design mixture if opting to have the Department perform the Hamburg Wheel test on the laboratory mixture when required in accordance with Table 5, and request that the Department perform the test.
- 4.4.2.1.4. **Supplying Aggregates.** Provide approximately 40 lb. of each aggregate stockpile unless otherwise directed.
- 4.4.2.1.5. **Supplying Asphalt.** Provide at least 1 gal. of the asphalt material and enough quantities of any additives proposed for use.
- 4.4.2.1.6. **Ignition Oven Correction Factors.** Determine the aggregate and asphalt correction factors from the ignition oven in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 mo. old. Note that the asphalt content correction factor takes into account the percent fibers in the mixture so that the fibers are excluded from the binder content determination. Provide the Engineer with split samples of the mixtures before the trial batch production, including all additives (except water), and blank samples used to determine the correction factors for the ignition oven used for quality assurance (QA) testing during production. Correction factors established from a previously approved mixture design may be used for the current mixture design if the mixture design and ignition oven are the same as previously used and the correction factors are not more than 12 mo. old, unless otherwise directed.
- 4.4.2.1.7. **Boil Test.** When shown on the plans, perform the test and retain the tested sample from [Tex-530-C](#) until completion of the project or as directed. Use this sample for comparison purposes during production. Add lime or liquid antistripping agent, as directed, if signs of stripping exist.
- 4.4.2.1.8. **Trial Batch Production.** Provide a plant-produced trial batch upon receiving conditional approval of JMF1 and authorization to produce a trial batch including the compaction aid or foaming process, if applicable, for verification testing of JMF1 and development of JMF2. Produce a trial batch mixture that meets the requirements in accordance with Table 6. The Engineer may accept test results from recent production of the same mixture instead of a new trial batch.
- 4.4.2.1.9. **Trial Batch Production Equipment.** Use only equipment and materials proposed for use on the project to produce the trial batch. Provide documentation to verify the calibration or accuracy of the asphalt mass flow meter to measure the binder content. Verify that asphalt mass flow meter meets the requirements of 0.4% accuracy, when required, in accordance with Item 520, "Weighing and Measuring Equipment." The Engineer may require that the accuracy of the mass flow meter be verified based on quantities used.
- 4.4.2.1.10. **Trial Batch Quantity.** Produce enough quantity of the trial batch to ensure that the mixture meets the specification requirements.
- 4.4.2.1.11. **Number of Trial Batches.** Produce trial batches as necessary to obtain a mixture that meets the specification requirements.
- 4.4.2.1.12. **Trial Batch Sampling.** Obtain a representative sample of the trial batch and split it into three equal portions in accordance with [Tex-222-F](#). Label these portions as "Contractor," "Engineer," and "Referee." Deliver samples to the appropriate laboratory as directed.
- 4.4.2.1.13. **Trial Batch Testing.** Test the trial batch to ensure the mixture produced using the proposed JMF1 meets the mixture requirements in accordance with Table 6. Ensure the trial batch mixture is also in compliance with the requirements in accordance with Table 5. Use a Department-approved laboratory listed on the MPL to perform

the Hamburg Wheel test on the trial batch mixture or request that the Department perform the Hamburg Wheel test. Provide an additional 25 lb. of the trial batch mixture if opting to have the Department perform the Hamburg Wheel test, if applicable, and request that the Department perform the test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the trial batch. Provide the Engineer with a copy of the trial batch test results.

- 4.4.2.1.14. **Development of JMF2.** Evaluate the trial batch test results, determine the target mixture proportions, and submit as JMF2 after the Engineer grants full approval of JMF1 based on results from the trial batch. The mixture produced using JMF2 must meet the requirements in accordance with Tables 4 and 5. Verify that JMF2 meets the operational tolerances in accordance with Table 6.
- 4.4.2.1.15. **Mixture Production.** Use JMF2 to produce Lot 1 after receiving approval for JMF2.
- 4.4.2.1.16. **Development of JMF3.** Evaluate the test results from Lot 1, determine the optimum mixture proportions, and submit as JMF3 for use in Lot 2.
- 4.4.2.1.17. **JMF Adjustments.** If JMF adjustments are necessary to achieve the specified requirements, make the adjustments before beginning a new lot. The adjusted JMF must:
- be provided to the Engineer in writing before the start of a new lot;
  - be numbered in sequence to the previous JMF;
  - meet the master gradation limits in accordance with Table 4; and
  - be within the operational tolerances of JMF2 in accordance with Table 6.
- 4.4.2.1.18. **Requesting Referee Testing.** Use referee testing, if needed, in accordance with Section 3079.4.9.1., "Referee Testing," to resolve testing differences with the Engineer.

**Table 6**  
**Operational Tolerances**

| Test Description                                       | Test Method                                     | Allowable Difference between JMF2 and JMF1 Target <sup>1</sup>  | Allowable Difference from Current JMF and JMF2 <sup>2</sup> | Allowable Difference between Contractor and Engineer <sup>3</sup> |
|--|---|---|---|---|
| Individual % retained for sieve sized larger than #200 | <a href="#">Tex-200-F</a>                       | Must be Within Master Grading Limits in accordance with Table 4 | $\pm 3.0^4$   | $\pm 5.0^4$   |
| % passing the #200 sieve                               |   |   |   | $\pm 2.0^4$   |
| Laboratory-molded density, %                           | <a href="#">Tex-207-F</a> , Part VIII           | $\pm 1.0$   | $\pm 1.0$   | $\pm 1.0$   |
| Asphalt binder content, %                              | <a href="#">Tex-236-F</a> , Part I <sup>5</sup> | $\pm 0.3^{6,7}$   | $\pm 0.3^{4,6,7}$   | $\pm 0.3^{6,7}$   |
| Drain-down, %  | <a href="#">Tex-235-F</a>                       | Note 8  | Note 8  | N/A   |
| Boil test  | <a href="#">Tex-530-C</a>                       | Note 9  | Note 9  | N/A   |

1. JMF1 is the approved laboratory mixture design used for producing the trial batch. JMF2 is the approved mixture design developed from the trial batch used to produce Lot 1.
2. Current JMF is JMF3 or higher. JMF3 is the approved mixture design used to produce Lot 2.
3. Contractor may request referee testing only when values exceed these tolerances.
4. Only applies to mixture produced for Lot 1 and higher. Aggregate gradation is not allowed to be outside the limits shown in Table 4.
5. Ensure the binder content determination excludes fibers.
6. May be obtained from asphalt mass flow meter readouts as determined by the Engineer.
7. Binder content is not allowed to be outside the limits in accordance with Table 5.
8. Verify that Table 5 requirements are met.
9. When shown on the plans.

4.4.2.2. **Engineer's Responsibilities.**

- 4.4.2.2.1. **Superpave Gyrotory Compactor.** The Engineer will use a Department SGC calibrated in accordance with [Tex-241-F](#) to mold samples for laboratory mixture design verification. For molding trial batch and production specimens, the Engineer will use the Contractor-provided SGC at the

field laboratory or provide and use a Department SGC at an alternate location.

4.4.2.2.2. **Conditional Approval of JMF1 and Authorizing Trial Batch.** The Engineer will review and verify conformance of the following information within two working days of receipt:

- the Contractor's mix design report (JMF1);
- the Contractor-provided Hamburg Wheel test results;
- all required materials including aggregates, asphalt, and additives; and
- the mixture specifications.

The Engineer will grant the Contractor conditional approval of JMF1 if the information provided on the paper copy of JMF1 indicates that the Contractor's mixture design meets the specifications. When the Contractor does not provide Hamburg Wheel test with laboratory mixture design, 10 working days are allowed for conditional approval of JMF1. The Engineer will base full approval of JMF1 on the test results on mixture from the trial batch.

Unless waived, the Engineer will determine the Micro-Deval abrasion loss in accordance with Section 3079.2.1.1.2., "Micro-Deval Abrasion." If the Engineer's test results are pending after two working days, conditional approval of JMF1 will still be granted within two working days of receiving JMF1. When the Engineer's test results become available, they will be used for specification compliance.

The Contractor is authorized to produce a trial batch after the Engineer grants conditional approval of JMF1.

4.4.2.2.3. **Hamburg Wheel Testing.** At the Contractor's request, the Department will perform the Hamburg Wheel test on the laboratory mixture in accordance with [Tex-242-F](#) to verify compliance with the Hamburg Wheel test requirement in accordance with Table 5. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the laboratory mixture design.

4.4.2.2.4. **Ignition Oven Correction Factors.** The Engineer will use the split samples provided by the Contractor to determine the aggregate and asphalt correction factors for the ignition oven used for QA testing during production in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 mo. old. The Engineer will verify that the asphalt content correction factor takes into account the percent fibers in the mixture so that the fibers are excluded from the binder content determination.

4.4.2.2.5. **Testing the Trial Batch.** Within one full working day, the Engineer will sample and test the trial batch to ensure that the mixture meets the requirements in accordance with Table 6. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the trial batch mixture, the Engineer will mold samples in accordance with [Tex-242-F](#) to verify compliance with the Hamburg Wheel test requirement in accordance with Table 5.

The Engineer will have the option to perform [Tex-530-C](#) on the trial batch when shown on the plans. These results may be retained and used for comparison purposes during production.

4.4.2.2.6. **Full Approval of JMF1.** The Engineer will grant full approval of JMF1 and authorize the Contractor to proceed with developing JMF2 if the Engineer's results for the trial batch meet the requirements in accordance with Table 5.

The Engineer will notify the Contractor that an additional trial batch is required if the trial batch does not meet these requirements.

4.4.2.2.7. **Approval of JMF2.** The Engineer will approve JMF2 within one working day if the mixture meets the requirements in accordance with Tables 4, 5, and 6.



- 4.4.2.2.8. **Approval of Lot 1 Production.** The Engineer will authorize the Contractor to proceed with Lot 1 production (using JMF2).
- 4.4.2.2.9. **Approval of JMF3 and Subsequent JMF Changes.** JMF3 and subsequent JMF changes are approved if they meet the master grading limits in accordance with Table 4, the asphalt binder content in accordance with Table 5, and are within the operational tolerances of JMF2 in accordance with Table 6.
- 4.4.2.2.10. **Binder Content Adjustments.** For JMF2 and above, the Engineer may require the Contractor to adjust the target binder content by no more than 0.3% from the current JMF.
- 4.5. **Production Operations.** Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification.
- 4.5.1. **Storage and Heating of Materials.** Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.
- 4.5.2. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed the maximum production temperatures in accordance with Table 7. The Department will not pay for or allow placement of any mixture produced above the maximum production temperatures in accordance with Table 7.

**Table 7**  
**Maximum Production Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Maximum Production Temperature |
|--|--------------------------------|
| PG 76                                      | 345°F                          |
| A-R Binder                                 | 345°F                          |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. Determine the moisture content, if requested, by oven-drying in accordance with [Tex-212-F](#), Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck and perform the test promptly.

- 4.6. **Hauling Operations.** Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent, when necessary, shown on the Department's MPL to coat the inside bed of the truck. Do not use diesel or any release agent not shown on the Department's MPL.

Use equipment for hauling as defined in Section 3079.4.7.3.3., "Hauling Equipment." Use other hauling equipment only when allowed.

- 4.7. **Placement Operations.** Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour or as directed. Use a hand-held thermal camera or infrared thermometer, when a thermal imaging system is not used, to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from

pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot-mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide within 6-in. of lane lines and are not placed in the wheel path, or as directed. Ensure that all finished surfaces will drain properly.

#### 4.7.1. **Weather Conditions.**

- 4.7.1.1. **When Using a Thermal Imaging System.** The Contractor may pave any time the roadway is dry and the roadway surface temperature is at least 60°F unless otherwise approved or as shown on the plans; however, the Engineer may restrict the Contractor from paving if the ambient temperature is likely to drop below 32°F within 12 hr. of paving. Place mixtures when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. Provide output data from the thermal imaging system to demonstrate to the Engineer that no recurring severe thermal segregation exists in accordance with Section 3079.4.7.3.1.2., "Thermal Imaging System."

Produce mixture with a target discharge temperature higher than 300°F and with a compaction aid to facilitate compaction when the air temperature is 70°F and falling.

- 4.7.1.1.1. **When Not Using a Thermal Imaging System.** When using a thermal camera instead of the thermal imaging system, place mixture when the roadway surface temperature is at or above 70°F unless otherwise approved or as shown on the plans. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the air temperature is 60°F and falling.

Produce mixture with a target discharge temperature higher than 300°F and with a compaction aid to facilitate compaction when the air temperature is 70°F and falling.

#### 4.7.2. **Tack Coat.**

- 4.7.2.1. **Application.** Clean the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns. Apply adequate overlap of the tack coat in the longitudinal direction during the placement of the mat to ensure bond of adjacent PFC mats, unless otherwise directed. Unless otherwise directed, avoid tacking the vertical faces of adjacent PFC mats in the longitudinal direction to avoid restricting lateral drainage. Apply tack coat to all transverse joints. Allow adequate time for emulsion to break completely before placing any material. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

- 4.7.2.2. **Sampling.** The Engineer will obtain at least one sample of the tack coat binder per project in accordance with [Tex-500-C](#), Part III, and test it to verify compliance with Item 300, "Asphalts, Oils, and Emulsions." The Engineer will notify the Contractor when the sampling will occur and will witness the collection of the sample from the asphalt distributor immediately before use. Label the can with the corresponding lot and subplot numbers, producer, producer facility, grade, district, date sampled, and project information including highway and CSJ. For emulsions, the Engineer may test as often as necessary to ensure the residual of the emulsion is greater than or equal to the specification requirement in Item 300, "Asphalts, Oils, and Emulsions."

- 4.7.3. **Lay-Down Operations.** Use the placement temperature in accordance with Table 8 to establish the minimum placement temperature of the mixture delivered to the paving operation.

**Table 8**  
**Minimum Mixture Placement Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Minimum Placement Temperature<br>(Before Entering Paving Operation) <sup>2,3</sup> |
|--|--|
| PG 76                                      | 280°F  |
| A-R Binder                                 | 280°F  |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. The mixture temperature must be measured using a hand-held thermal camera or infrared thermometer nearest to the point of entry of the paving operation.
3. Minimum placement temperatures may be reduced 10°F if using a compaction aid.

4.7.3.1. **Thermal Profile.** Use a hand-held thermal camera or a thermal imaging system to obtain a continuous thermal profile in accordance with [Tex-244-F](#). Thermal profiles are not applicable in areas described in Section 3079.4.9.3.2., "Miscellaneous Areas."

4.7.3.1.1. **Thermal Segregation.**

4.7.3.1.1.1. **Moderate.** Any areas that have a temperature differential greater than 25°F, but not exceeding 50°F.

4.7.3.1.1.2. **Severe.** Any areas that have a temperature differential greater than 50°F.

4.7.3.1.2. **Thermal Imaging System.** Review the output results when a thermal imaging system is used, and provide the report described in [Tex-244-F](#) to the Engineer daily. Modify the paving process as necessary to eliminate any recurring (moderate or severe) thermal segregation identified by the thermal imaging system.-

The Engineer may suspend subsequent paving operations if the Contractor cannot successfully modify the paving process to eliminate recurring severe or moderate thermal segregation.

Provide the Engineer with electronic copies of all daily data files that can be used with the thermal imaging system software to generate temperature profile plots daily or as requested by the Engineer.

4.7.3.1.2.1. **Thermal Camera.** When using a thermal camera instead of the thermal imaging system, take immediate corrective action to eliminate recurring moderate thermal segregation when a hand-held thermal camera is used. Provide the Engineer with the thermal profile of every subplot within one working day of the completion of each lot. When requested by the Engineer, provide the electronic files generated using the thermal camera. Report the results of each thermal profile in accordance with Section 3079.4.2., "Reporting and Responsibilities." The Engineer will use a hand-held thermal camera to obtain a thermal profile at least once per project. Suspend operations and take immediate corrective action to eliminate severe thermal segregation unless otherwise directed. Resume operations when the Engineer determines that subsequent production will meet the requirements of this Section.

4.7.3.2. **Windrow Operations.** Operate windrow pickup equipment so that when hot-mix is placed in windrows, substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

4.7.3.3. **Hauling Equipment.** Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture; however, with exception of paving miscellaneous areas, end dump trucks are only allowed when used in conjunction with an MTD with remixing capability or when a thermal imaging system is used unless otherwise allowed.

4.7.3.4. **Screed Heaters.** Turn off screed heaters to prevent overheating of the mat if the paver stops for more than 5 min. The Engineer may evaluate the suspect area in accordance with Section 3079.4.9.3.3., "Recovered Asphalt Dynamic Shear Rheometer (DSR)," if the screed heater remains on for more than 5 min. while the paver is stopped.

4.8. **Compaction.** Roll the freshly placed PFC with as many steel-wheeled rollers as necessary, operated in static mode, to seat the mixture without excessive breakage of the aggregate and to provide a smooth surface and uniform texture. Do not use pneumatic rollers. Moisten the roller drums thoroughly with a soap and water solution to prevent adhesion. Use only water or an approved release agent on rollers, tamps, and

other compaction equipment unless otherwise directed.

Use [Tex-246-F](#) to test and verify that the compacted mixture has adequate permeability. Measure the water flow once per subplot at locations directed by the Engineer. The water flow rate must be less than 20 sec. Investigate the cause of the water flow rate test failures and take corrective actions during production and placement to ensure the water flow rate is less than 20 sec. Suspend production if two consecutive water flow rate tests fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

Complete all compaction operations before the pavement temperature drops below 180°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 180°F.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

- 4.9. **Acceptance Plan.** Sample and test the hot-mix on a lot and subplot basis.
- 4.9.3. **Referee Testing.** The Materials and Tests Division is the referee laboratory. The Contractor may request referee testing if the differences between Contractor and Engineer test results exceed the operational tolerances in accordance with Table 6 and the differences cannot be resolved. The Contractor may also request referee testing if the Engineer's test results require suspension of production and the Contractor's test results are within specification limits. Make the request within five working days after receiving test results and cores from the Engineer. Referee tests will be performed only on the subplot in question and only for the particular tests in question. Allow 10 working days from the time the referee laboratory receives the samples for test results to be reported. The Department may require the Contractor to reimburse the Department for referee tests if more than three referee tests per project are required and the Engineer's test results are closer to the referee test results than the Contractor's test results.
- 4.9.4. **Production Acceptance.**
- 4.9.4.1. **Production Lot.** A production lot consists of four equal sublots. The default quantity for Lot 1 is 1,000 ton; however, when requested by the Contractor, the Engineer may increase the quantity for Lot 1 to no more than 2,000 ton. The Engineer will select subsequent lot sizes based on the anticipated daily production such that approximately three to four sublots are produced each day. The lot size will be between 1,000 ton and 4,000 ton. The Engineer may change the lot size before the Contractor begins any lot.
- 4.9.4.1.1. **Incomplete Production Lots.** If a lot is begun but cannot be completed, such as on the last day of production or in other circumstances deemed appropriate, the Engineer may close the lot. Close all lots within five working days unless otherwise allowed.
- 4.9.4.2. **Production Sampling.**
- 4.9.4.2.1. **Mixture Sampling.** Obtain hot-mix samples from trucks at the plant in accordance with [Tex-222-F](#). The sampler will split each sample into three equal portions in accordance with [Tex-200-F](#) and label these portions as "Contractor," "Engineer," and "Referee." The Engineer will perform or witness the sample splitting and take immediate possession of the samples labeled "Engineer" and "Referee." The Engineer will maintain the custody of the samples labeled "Engineer" and "Referee" until the Department's testing is completed.
- 4.9.4.2.1.1. **Random Sample.** At the beginning of the project, the Engineer will select random numbers for all production sublots. Determine sample locations in accordance with [Tex-225-F](#). Take one sample for each subplot at the randomly selected location. The Engineer will perform or witness the sampling of production sublots.
- 4.9.4.2.1.2. **Blind Sample.** For one subplot per lot, the Engineer will obtain and test a "blind" sample instead of the random sample collected by the Contractor. Test either the "blind" or the random sample; however, referee testing (if applicable) will be based on a comparison of results from the "blind" sample. The location of the Engineer's "blind" sample will not be disclosed to the Contractor. The Engineer's "blind" sample may be randomly selected in accordance with [Tex-225-F](#) for any subplot or selected at the discretion of the Engineer. The

Engineer will use the Contractor's split sample for sublots not sampled by the Engineer.

4.9.4.2.2. **Informational Shear Bond Strength Testing.** Select one random subplot from Lot 2 or higher for shear bond strength testing. Obtain full depth cores in accordance with [Tex-249-F](#). Label the cores with the Control Section Job (CSJ), producer of the tack coat, mix type, shot rate, lot, and subplot number and provide to the Engineer. The Engineer will ship the cores to the Materials and Tests Division or district laboratory for shear bond strength testing. Results from these tests will not be used for specification compliance.

4.9.4.2.3. **Informational Hamburg and Overlay Testing.** Select one random subplot from Lot 2 or higher for Hamburg and Overlay testing during the first week of production. Obtain and provide the Engineer with approximately 90 lb. of mixture, sampled in accordance with [Tex-222-F](#), in sealed containers, boxes, or bags labeled with the Control-Section-Job (CSJ), mixture type, lot, and subplot number. The Engineer will ship the mixture to the Materials and Tests Division for Hamburg and Overlay testing. Results from these tests will not be used for specification compliance.

4.9.4.2.4. **Asphalt Binder Sampling.** Obtain a 1 qt. (1 gal. for A-R binder) sample of the asphalt binder witness by the Engineer for each lot of mixture produced. The Contractor will notify the Engineer when the sampling will occur. Obtain the sample at approximately the same time the mixture random sample is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill and upstream from the introduction of any additives in accordance with [Tex-500-C](#), Part II. Label the can with the corresponding lot and subplot numbers, producer, producer facility, grade, district, date sampled, and project information including highway and CSJ. The Engineer will retain these samples for one year. The Engineer may also obtain independent samples. If obtaining an independent asphalt binder sample and upon request of the Contractor, the Engineer will split a sample of the asphalt binder with the Contractor

At least once per project, the Engineer will collect split samples of each binder grade and source used. The Engineer will submit one split sample to the Materials and Tests Division to verify compliance with Item 300, "Asphalts, Oils, and Emulsions" and will retain the other split sample for one year.

4.9.4.3. **Production Testing.** The Contractor and Engineer must perform production tests in accordance with Table 9. The Contractor has the option to verify the Engineer's test results on split samples provided by the Engineer. Determine compliance with operational tolerances in accordance with Table 6 for all sublots.

At any time during production, the Engineer may require the Contractor to verify the following based on quantities used:

- lime content (within  $\pm 0.1\%$  of JMF), when PG binder is specified;
- fiber content (within  $\pm 0.03\%$  of JMF), when PG binder is specified; and
- CRM content (within  $\pm 1.5\%$  of JMF), when A-R binder is specified.

Maintain the in-line measuring device when A-R binder is specified to verify the A-R binder viscosity between 2,500 and 4,000 centipoise at 350°F unless otherwise approved. Record A-R binder viscosity at least once per hour and provide the Engineer with a daily summary unless otherwise directed.

If the aggregate mineralogy is such that [Tex-236-F](#), Part I does not yield reliable results, the Engineer may allow alternate methods for determining the asphalt content and aggregate gradation. The Engineer will require the Contractor to provide evidence that results from [Tex-236-F](#), Part I are not reliable before permitting an alternate method unless otherwise allowed. Use the applicable test procedure as directed if an alternate test method is allowed.

**Table 9**  
**Production and Placement Testing Frequency**

| Description  | Test Method                                     | Minimum Contractor Testing Frequency | Minimum Engineer Testing Frequency |
|--|---|--------------------------------------|------------------------------------|
| Individual % retained for sieve sized larger than #200 | <a href="#">Tex-200-F</a>                       | 1 per subplot                        | 1 per 12 sublots                   |
| % passing the #200 sieve                               |   |                                      |                                    |
| Laboratory-molded density, %                           | <a href="#">Tex-207-F</a> , Part VIII           | 1 per subplot                        | 1 per lot                          |
| Asphalt binder content <sup>1</sup> , %                | <a href="#">Tex-236-F</a> , Part I <sup>2</sup> | 1 per subplot                        | 1 per lot                          |
| Drain-down, %  | <a href="#">Tex-235-F</a>                       | 1 per subplot                        | 1 per 12 sublots                   |
| Boil test <sup>3</sup>                                 | <a href="#">Tex-530-C</a>                       | 1 per project                        | 1 per project                      |
| Moisture content                                       | <a href="#">Tex-212-F</a> , Part II             | When directed                        | 1 per project                      |
| Cantabro loss, %                                       | <a href="#">Tex-245-F</a>                       | 1 per project (sample only)          | 1 per project                      |
| Overlay test   | <a href="#">Tex-248-F</a>                       | 1 per project (sample only)          | 1 per project <sup>4,9</sup>       |
| Hamburg Wheel test                                     | <a href="#">Tex-242-F</a>                       | 1 per project (sample only)          | 1 per project <sup>4,9</sup>       |
| Water flow test  | <a href="#">Tex-246-F</a>                       | 1 per subplot                        | 1 per project                      |
| Asphalt binder sampling                                | <a href="#">Tex-500-C</a> , Part II             | 1 per lot (sample only) <sup>5</sup> | 1 per project                      |
| Tack coat sampling and testing                         | <a href="#">Tex-500-C</a> , Part III            | N/A                                  | 1 per project                      |
| Thermal profile  | <a href="#">Tex-244-F</a>                       | 1 per subplot, <sup>6,7,8</sup>      | 1 per project <sup>7</sup>         |

1. May be obtained from t mass flow meter readouts as determined by the Engineer.
2. Ensure the binder content determination excludes fibers.
3. When shown on the plans.
4. Testing performed by the Materials and Tests Division on sample obtained from Lot 2 or higher.
5. Obtain samples witness by the Engineer. The Engineer will retain these samples for one year.
6. To be performed in the presence of the Engineer when using the thermal camera, unless otherwise approved.
7. Not required when a thermal imaging system is used.
8. When using the thermal imaging system, the test report must include the temperature measurements taken in accordance with Tex-244-F.
9. Testing performed by the Materials and Tests Division for informational purposes only.

4.9.4.4. **Operational Tolerances.** Control the production process within the operational tolerances in accordance with Table 6. Suspend production and placement operations when production or placement test results exceed the tolerances in accordance with Table 6 unless otherwise allowed. When production is suspended, the Engineer will allow production to resume when test results or other information indicates the next mixture produced will be within the operational tolerances.

4.9.4.5. **Individual Loads of Hot-Mix.** The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances in accordance with Table 6, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.

4.9.5. **Placement Acceptance.**

4.9.5.1. **Placement Lot.** A placement lot consists of four placement sublots. A placement subplot consists of the area placed during a production subplot.

4.9.5.2. **Miscellaneous Areas.** Miscellaneous areas include areas that typically involve significant handwork or discontinuous paving operations such as driveways, mailbox turnouts, crossovers, gores, spot level-up

areas, and other similar areas. The specified layer thickness is based on the rate of 90 lb. per square yard for each inch of pavement unless another rate is shown on the plans. Miscellaneous areas are not subject to thermal profiles testing.

4.9.5.3. **Recovered Asphalt Dynamic Shear Rheometer (DSR).** The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Materials and Tests Division. The aging ratio is the DSR value of the extracted binder divided by the DSR value of the original unaged binder. Obtain DSR values in accordance with AASHTO T 315 at the specified high temperature performance grade of the asphalt. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores in accordance with [Tex-211-F](#).

4.9.5.4. **Irregularities.** Identify and correct irregularities, including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. If the Engineer determines that the irregularity will adversely affect pavement performance, the Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities. The Engineer may also require the Contractor to remove and replace (at the Contractor's expense) areas where the mixture does not bond to the existing pavement.

If irregularities are detected, the Engineer may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.

4.9.6. **Exempt Production.** When the anticipated daily production is less than 100 ton, all QC and QA sampling and testing are waived. The Engineer may deem the mixture as exempt production for the following conditions:

- anticipated daily production is more than 100 ton but less than 250 ton;
- total production for the project is less than 2,500 ton;
- when mutually agreed between the Engineer and the Contractor; or
- when shown on the plans.

For exempt production, the Contractor is relieved of all production and placement sampling and testing requirements. All other specification requirements apply, and the Engineer will perform acceptance tests for production and placement in accordance with Table 9.

For exempt production:

- produce, haul, place, and compact the mixture as directed by the Engineer; and
- control mixture production to yield a laboratory-molded density that is within  $\pm 1.0\%$  of the target density as tested by the Engineer.

4.9.7. **Ride Quality.** Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

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## 5. MEASUREMENT

5.1. **PFC Hot-Mix Asphalt.** Permeable friction course (PFC) hot-mix will be measured by the ton of composite mixture which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."

5.2. **Tack Coat.** Tack coat will be measured at the applied temperature by strapping the tank before and after road application and determining the net volume in gallons from the calibrated distributor. The Engineer will witness all strapping operations for volume determination. All tack, including emulsions, will be measured by the gallon applied.

The Engineer may allow the use of a metering device to determine asphalt volume used and application rate if the device is accurate to within 1.5% of the strapped volume.

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**6. PAYMENT**

The work performed and materials furnished in accordance with this Item and measured as provided under Section 3079.5.1., "PFC Hot-Mix Asphalt," will be paid for at the unit bid price for "Permeable friction course Hot Mix Asphalt" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, materials, placement, equipment, labor, tools, and incidentals.

The work performed and materials furnished in accordance with this Item and measured as provided under Section 3079.5.2., "Tack Coat," will be paid for at the unit bid price for "Tack Coat" of the tack coat provided. These prices are full compensation for materials, placement, equipment, labor, tools, and incidentals.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."



# Special Specification 3081

## Thin Overlay Mixtures



### 1. DESCRIPTION

Construct a thin surface course composed of a compacted mixture of aggregate and asphalt binder mixed hot in a mixing plant. Produce a thin overlay mixture (TOM) with a minimum lift thickness of 1/2 in. for a Type F mixture and 3/4 in. for a Type C mixture.

### 2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

2.1. **Aggregate.** Furnish aggregates from sources that conform to the requirements in accordance with Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse, intermediate, or fine aggregate. Do not use reclaimed asphalt pavement (RAP) or recycled asphalt shingles (RAS). Supply aggregates that meet the definitions in accordance with [Tex-100-E](#) for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests in accordance with Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis in accordance with [Tex-200-F](#), Part II.

2.1.1. **Coarse Aggregate.** Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance;
- approved only when tested by the Engineer;
- once approved, do not add material to the stockpile unless otherwise approved; and
- allow 30 calendar days for the Engineer to sample, test, and report results.

2.1.1.1. **Blending Class A and Class B Aggregates.** Class B aggregate meeting all other requirements in blending Class A and B aggregates to meet a Class A requirement, ensure that at least 50% by weight, or volume if required, of all aggregates used in the mixture design retained on the No. 8 sieve comes from the Class A

aggregate source, unless otherwise shown on the plans. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. Class B aggregate may be disallowed when shown on the plans.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 8 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 8 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

- 2.1.1.2. **Micro-Deval Abrasion.** The Engineer will perform a minimum of one Micro-Deval abrasion test in accordance with [Tex-461-A](#) for each coarse aggregate source used in the mixture design that has a Rated Source Soundness Magnesium (RSSM) loss value greater than 15 as listed in the BRSQC, unless otherwise directed. The Engineer will perform testing before the start of production and may perform additional testing at any time during production. The Engineer may obtain the coarse aggregate samples from each coarse aggregate source or may require the Contractor to obtain the samples. The Engineer may waive all Micro-Deval testing based on a satisfactory test history of the same aggregate source.

The Engineer will estimate the magnesium sulfate soundness loss for each coarse aggregate source, when tested, using the following formula:

$$Mg_{est.} = (RSSM)(MD_{act.}/RSMD)$$

where:

$Mg_{est}$  = magnesium sulfate soundness loss

RSSM = Rated Source Soundness Magnesium

$MD_{act}$  = actual Micro-Deval percent loss

RSMD = Rated Source Micro-Deval

When the estimated magnesium sulfate soundness loss is greater than the maximum magnesium sulfate soundness loss specified, the coarse aggregate source will not be allowed for use unless otherwise approved. The Engineer will consult the Soils and Aggregates Section of the Materials and Tests Division, and additional testing may be required before granting approval.

- 2.1.2. **Intermediate Aggregate.** Aggregates not meeting the definition of coarse or fine aggregate will be defined as intermediate aggregate. Supply intermediate aggregates, when used that are free from organic impurities. The Engineer may test the intermediate aggregate in accordance with [Tex-408-A](#) to verify the material is free from organic impurities. Supply intermediate aggregate from coarse aggregate sources, when used that meet the requirements in accordance with Table 1 unless otherwise approved.

If 10% or more of the stockpile is retained on the No. 4 sieve, verify that it meets the requirements in accordance with Table 1 for crushed face count ([Tex-460-A](#)) and flat and elongated particles ([Tex-280-F](#)).

- 2.1.3. **Fine Aggregate.** Fine aggregates consist of manufactured sands and screenings. Natural sands are not allowed in any mixture. Fine aggregate stockpiles must meet the fine aggregate properties in accordance with Table 1 and the gradation requirements in accordance with Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with [Tex-408-A](#) to verify the material is free from organic impurities. Use fine aggregate from coarse aggregate sources that meet the requirements in accordance with Table 1 unless otherwise approved.

If 10% or more of the stockpile is retained on the No. 4 sieve, verify that it meets the requirements in accordance with Table 1 for crushed face count ([Tex-460-A](#)) and flat and elongated particles ([Tex-280-F](#)).

**Table 1**  
**Aggregate Quality Requirements**

| Property                                      | Test Method                         | Requirement       |
|---|-------------------------------------|-------------------|
| <b>Coarse Aggregate</b>                       |                                     |                   |
| SAC   | <a href="#">Tex-499-A</a>           | A <sup>1</sup>    |
| Deleterious material, %, Max                  | <a href="#">Tex-217-F</a> , Part I  | 1.5               |
| Decantation, %, Max                           | <a href="#">Tex-217-F</a> , Part II | 1.5               |
| Micro-Deval abrasion, %                       | <a href="#">Tex-461-A</a>           | Note <sup>f</sup> |
| Los Angeles abrasion, %, Max                  | <a href="#">Tex-410-A</a>           | 30                |
| Magnesium sulfate soundness, 5 cycles, %, Max | <a href="#">Tex-411-A</a>           | 20                |
| Crushed face count, <sup>3</sup> %, Min       | <a href="#">Tex-460-A</a> , Part I  | 95                |
| Flat and elongated particles @ 5:1, %, Max    | <a href="#">Tex-280-F</a>           | 10                |
| <b>Fine Aggregate</b>                         |                                     |                   |
| Linear shrinkage, %, Max                      | <a href="#">Tex-107-E</a>           | 3                 |
| Sand equivalent, %, Min                       | <a href="#">Tex-203-F</a>           | 45                |

1. Surface Aggregate Classification of "A" is required unless otherwise shown on the plans.
2. Used to estimate the magnesium sulfate soundness loss in accordance with Section 3081.2.1.1.2., "Micro-Deval Abrasion."
3. Only applies to crushed gravel.

**Table 2**  
**Gradation Requirements for Fine Aggregate**

| Sieve Size | % Passing by Weight or Volume |
|------------|-------------------------------|
| 3/8"       | 100                           |
| #8         | 70-100                        |
| #200       | 0-30                          |

- 2.2. **Mineral Filler.** Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, or hydrated lime. Mineral filler is allowed unless otherwise shown on the plans. Fly ash is not permitted unless otherwise shown on the plans. Use no more than 2% hydrated lime unless otherwise shown on the plans. Test all mineral fillers except hydrated lime and fly ash in accordance with [Tex-107-E](#) to ensure specification compliance. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:
- is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
  - does not exceed 3% linear shrinkage when tested in accordance with [Tex-107-E](#); and
  - meets the gradation requirements in Table 3, unless otherwise shown on the plans.

**Table 3**  
**Gradation Requirements for Mineral Filler**

| Sieve Size | % Passing by Weight or Volume |
|------------|-------------------------------|
| #8         | 100                           |
| #200       | 55-100                        |

- 2.3. **Baghouse Fines.** Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.
- 2.4. **Asphalt Binder.** Furnish performance-graded (PG) asphalt binder with a high temperature grade of PG 76 unless otherwise shown in the plans and a low temperature grade as shown on the plans, in accordance with Section 300.2.10., "Performance-Graded Binders."
- 2.5. **Tack Coat.** Furnish CSS-1H, SS-1H, EBL, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, "Asphalts, Oils, and Emulsions." Specialized tack coat materials listed on the Department's Tracking Resistant Asphalt Interlayer (TRAIL) MPL may be allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

- 2.6. **Additives.** Provide the Engineer with documentation such as the bill of lading showing the quantity of additives used in the project unless otherwise directed.
- 2.6.1. **Lime and Liquid Antistripping Agent.** When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Use no more than 1% hydrated lime when using crushed gravel. Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.
- 2.6.2. **Compaction Aid.** Compaction Aid is defined as a department-approved chemical warm mix additive denoted as "chemical additive" on the Department's materials producer list (MPL) that is used to facilitate mixing and compaction of HMA.
- Compaction Aid is allowed for use on all projects. Compaction aid is required when shown on the plans or as required in Section 3081.4.7.1., "Weather Conditions."
- Warm mix foaming processes, denoted as "foaming process" on the Department-approved MPL, may be used to facilitate mixing and compaction of HMA; however warm mix foaming processes are not defined as a Compaction Aid.
- 2.7. **Recycled Materials.** Recycled materials are not allowed for use.

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### 3. EQUIPMENT

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

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### 4. CONSTRUCTION

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a mandatory pre-paving meeting with the Engineer on or before the first day of paving unless otherwise shown on the plans.

- 4.1. **Certification.** Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 4. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist. Provide Level 1A certified specialists at the plant during production operations. Provide Level 1B certified specialists to conduct placement tests. Provide AGG101 certified specialists for aggregate testing.

**Table 4**  
**Test Methods, Test Responsibility, and Minimum Certification Levels**

| Test Description                                  | Test Method                              | Contractor | Engineer | Level <sup>1</sup> |
|---|--|------------|----------|--------------------|
| <b>1. Aggregate Testing</b>                       |  |            |          |                    |
| Sampling  | <a href="#">Tex-221-F</a>                | ✓          | ✓        | 1A/AGG101          |
| Dry sieve   | <a href="#">Tex-200-F</a> , Part I       | ✓          | ✓        | 1A/AGG101          |
| Washed sieve                                      | <a href="#">Tex-200-F</a> , Part II      | ✓          | ✓        | 1A/AGG101          |
| Deleterious material                              | <a href="#">Tex-217-F</a> , Part I       | ✓          | ✓        | AGG101             |
| Decantation                                       | <a href="#">Tex-217-F</a> , Part II      | ✓          | ✓        | AGG101             |
| Los Angeles abrasion                              | <a href="#">Tex-410-A</a>                |            | ✓        | Department         |
| Magnesium sulfate soundness                       | <a href="#">Tex-411-A</a>                |            | ✓        | Department         |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                |            | ✓        | AGG101             |
| Crushed face count                                | <a href="#">Tex-460-A</a>                | ✓          | ✓        | AGG101             |
| Flat and elongated particles                      | <a href="#">Tex-280-F</a>                | ✓          | ✓        | AGG101             |
| Sand equivalent                                   | <a href="#">Tex-203-F</a>                | ✓          | ✓        | AGG101             |
| Organic impurities                                | <a href="#">Tex-408-A</a>                | ✓          | ✓        | AGG101             |
| Methylene blue test                               | <a href="#">Tex-252-F</a>                |            | ✓        | Department         |
| <b>2. Asphalt Binder &amp; Tack Coat Sampling</b> |  |            |          |                    |
| Asphalt binder sampling                           | <a href="#">Tex-500-C</a> , Part II      | ✓          | ✓        | 1A/1B              |
| Tack coat sampling                                | <a href="#">Tex-500-C</a> , Part III     | ✓          | ✓        | 1A/1B              |
| <b>3. Mix Design &amp; Verification</b>           |  |            |          |                    |
| Design and JMF changes                            | <a href="#">Tex-204-F</a>                | ✓          | ✓        | 2                  |
| Mixing  | <a href="#">Tex-205-F</a>                | ✓          | ✓        | 2                  |
| Molding (TGC)                                     | <a href="#">Tex-206-F</a>                | ✓          | ✓        | 1A                 |
| Molding (SGC)                                     | <a href="#">Tex-241-F</a>                | ✓          | ✓        | 1A                 |
| Laboratory-molded density                         | <a href="#">Tex-207-F</a> , Parts I & VI | ✓          | ✓        | 1A                 |
| Rice gravity                                      | <a href="#">Tex-227-F</a> , Part II      | ✓          | ✓        | 1A                 |
| Drain-down  | <a href="#">Tex-235-F</a>                | ✓          | ✓        | 1A                 |
| Ignition oven correction factors <sup>2</sup>     | <a href="#">Tex-236-F</a> , Part II      | ✓          | ✓        | 2                  |
| Indirect tensile strength                         | <a href="#">Tex-226-F</a>                | ✓          | ✓        | 1A                 |
| Overlay test                                      | <a href="#">Tex-248-F</a>                |            | ✓        | Department         |
| Hamburg Wheel test                                | <a href="#">Tex-242-F</a>                | ✓          | ✓        | 1A                 |
| Boil test <sup>4</sup>                            | <a href="#">Tex-530-C</a>                | ✓          | ✓        | 1A                 |
| <b>4. Production Testing</b>                      |  |            |          |                    |
| Selecting production random numbers               | <a href="#">Tex-225-F</a> , Part I       |            | ✓        | 1A                 |
| Mixture sampling                                  | <a href="#">Tex-222-F</a>                | ✓          | ✓        | 1A/1B              |
| Molding (TGC)                                     | <a href="#">Tex-206-F</a>                | ✓          | ✓        | 1A                 |
| Molding (SGC)                                     | <a href="#">Tex-241-F</a>                | ✓          | ✓        | 1A                 |
| Laboratory-molded density                         | <a href="#">Tex-207-F</a> , Parts I & VI | ✓          | ✓        | 1A                 |
| Rice gravity                                      | <a href="#">Tex-227-F</a> , Part II      | ✓          | ✓        | 1A                 |
| Gradation & asphalt binder content <sup>2</sup>   | <a href="#">Tex-236-F</a> , Part I       | ✓          | ✓        | 1A                 |
| Drain-down  | <a href="#">Tex-235-F</a>                | ✓          | ✓        | 1A                 |
| Control charts                                    | <a href="#">Tex-233-F</a>                | ✓          | ✓        | 1A                 |
| Moisture content                                  | <a href="#">Tex-212-F</a> , Part II      | ✓          | ✓        | 1A/AGG101          |
| Hamburg Wheel test                                | <a href="#">Tex-242-F</a>                | ✓          | ✓        | 1A                 |
| Overlay test                                      | <a href="#">Tex-248-F</a>                | ✓          | ✓        | Department         |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                |            | ✓        | AGG101             |
| Boil test <sup>4</sup>                            | <a href="#">Tex-530-C</a>                | ✓          | ✓        | 1A                 |
| Abson recovery                                    | <a href="#">Tex-211-F</a>                |            | ✓        | Department         |
| <b>5. Placement Testing</b>                       |  |            |          |                    |
| Establish rolling pattern                         | <a href="#">Tex-207-F</a> , Part IV      | ✓          |          | 1B                 |
| In-place density (nuclear method)                 | <a href="#">Tex-207-F</a> , Part III     | ✓          |          | 1B                 |
| Control charts                                    | <a href="#">Tex-233-F</a>                | ✓          | ✓        | 1A                 |
| Ride quality measurement                          | <a href="#">Tex-1001-S</a>               | ✓          | ✓        | Note 3             |
| Thermal profile                                   | <a href="#">Tex-244-F</a>                | ✓          | ✓        | 1B                 |
| Water flow test                                   | <a href="#">Tex-246-F</a>                | ✓          | ✓        | 1B                 |

- Level 1A, 1B, AGG101, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.
- Refer to Section 3081.4.9.2.3., "Production Testing," for exceptions to using an ignition oven.
- Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.
- When shown on the plans.

4.2.

**Reporting and Responsibilities.** Use Department-provided templates to record and calculate all test data, including mixture design, production and placement QC/QA, control charts, and thermal profiles. Obtain the current version of the templates at <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html> or from the Engineer. The Engineer and the Contractor will provide any available test results to the other party when requested. The maximum allowable time for the Contractor and Engineer to exchange test data is as given in Table 5 unless otherwise approved. The Engineer and the Contractor will immediately report to the other party any test result that requires suspension of production or placement or that fails to meet the specification requirements. Record and electronically submit all test results and pertinent information on Department-provided templates.

Subsequent sublots placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Section 5.3., "Conformity with Plans, Specifications, and Special Provisions."

**Table 5**  
**Reporting Schedule**

| Description                            | Reported By | Reported To | To Be Reported Within                      |
|--|-------------|-------------|--|
| <b>Production Quality Control</b>      |             |             |  |
| Gradation <sup>1</sup>                 | Contractor  | Engineer    | 1 working day of completion of the subplot |
| Asphalt binder content <sup>1</sup>    |             |             |  |
| Laboratory-molded density <sup>2</sup> |             |             |  |
| Moisture content <sup>3</sup>          |             |             |  |
| Boil test <sup>5</sup>                 |             |             |  |
| <b>Production Quality Assurance</b>    |             |             |  |
| Gradation <sup>3</sup>                 | Engineer    | Contractor  | 1 working day of completion of the subplot |
| Asphalt binder content <sup>3</sup>    |             |             |  |
| Laboratory-molded density <sup>1</sup> |             |             |  |
| Hamburg Wheel test <sup>4</sup>        |             |             |  |
| Overlay test <sup>4</sup>              |             |             |  |
| Boil test <sup>5</sup>                 |             |             |  |
| Binder tests <sup>4</sup>              |             |             |  |
| <b>Placement Quality Control</b>       |             |             |  |
| Thermal profile <sup>1</sup>           | Contractor  | Engineer    | 1 working day of completion of the lot     |
| Water flow <sup>1</sup>                |             |             |  |
| <b>Placement Quality Assurance</b>     |             |             |  |
| Thermal profile <sup>3</sup>           | Engineer    | Contractor  | 1 working day of completion of the lot     |
| Aging ratio <sup>4</sup>               |             |             |  |
| Water flow                             |             |             |  |

1. These tests are required on every subplot.
2. Optional test. When performed on split samples, report the results as soon as they become available.
3. To be performed at the frequency specified and in accordance with Table 13 or as shown on the plans.
4. To be reported as soon as the results become available.
5. When shown on the plans.

Use the procedures described in [Tex-233-E](#) to plot the results of all quality control (QC) and quality assurance (QA) testing. Update the control charts as soon as test results for each subplot become available. Make the control charts readily accessible at the field laboratory. The Engineer may suspend production for failure to update control charts.

4.3.

**Quality Control Plan (QCP).** Develop and follow the QCP in detail. Obtain approval for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Submit a written QCP before the mandatory pre-paving meeting. Receive approval of the QCP before pre-paving meeting. Include the following items in the QCP:

- 4.3.1. **Project Personnel.** For project personnel, include:
- a list of individuals responsible for QC with authority to take corrective action;
  - current contact information for each individual listed; and
  - current copies of certification documents for individuals performing specified QC functions.
- 4.3.2. **Material Delivery and Storage.** For material delivery and storage, include:
- the sequence of material processing, delivery, and minimum quantities to assure continuous plant operations;
  - aggregate stockpiling procedures to avoid contamination and segregation;
  - frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
  - procedure for monitoring the quality and variability of asphalt binder.
- 4.3.3. **Production.** For production, include:
- loader operation procedures to avoid contamination in cold bins;
  - procedures for calibrating and controlling cold feeds;
  - procedures to eliminate debris or oversized material;
  - procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, lime, liquid antistripping, compaction aid, foaming process);
  - procedures for reporting job control test results; and
  - procedures to avoid segregation and drain-down in the silo.
- 4.3.4. **Loading and Transporting.** For loading and transporting, include:
- type and application method for release agents; and
  - truck loading procedures to avoid segregation.
- 4.3.5. **Placement and Compaction.** For placement and compaction, include:
- proposed agenda for mandatory pre-paving meeting, including date and location;
  - proposed paving plan (e.g., production rate, paving widths, joint offsets, and lift thicknesses);
  - type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
  - procedures for the transfer of mixture into the paver, while avoiding physical and thermal segregation and preventing material spillage;
  - process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality;
  - paver operations (e.g., speed, operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
  - procedures to construct quality longitudinal and transverse joints.
- 4.4. **Mixture Design.**
- 4.4.1. **Design Requirements.** The Contractor may design the mixture using a Texas Gyrotory Compactor (TGC) or a Superpave Gyrotory Compactor (SGC) unless otherwise shown on the plans. Use the typical weight design example given in [Tex-204-F](#), Part I, when using a TGC. Use the Superpave mixture design procedure provided in [Tex-204-F](#), Part IV, when using a SGC. Design the mixture to meet the requirements in accordance with Tables 1, 2, 3, 6, and 7.
- 4.4.1.1. **Target Laboratory-Molded Density When the TGC Is Used.** Design the mixture at a 97.5% target laboratory-molded density or in accordance with Table 7.

## 4.4.1.2.

**Design Number of Gyration (N<sub>design</sub>) When the SGC Is Used.** Design the mixture at 50 gyrations (N<sub>design</sub>). Use a target laboratory-molded density of 96.0% to design the mixture; however, adjustments can be made to the N<sub>design</sub> value as noted in Table 7. The N<sub>design</sub> level may be reduced to no less than 35 gyrations at the Contractor's discretion.

Use an approved laboratory from the Department's MPL to perform the Hamburg Wheel test, and the Department will perform the Overlay test and provide results with the mixture design, or provide the laboratory mixture and request that the Department perform the Hamburg Wheel test and Overlay test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test and Overlay test results on the laboratory mixture design.

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF 1) before the Contractor can begin production.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- the target laboratory-molded density (or N<sub>design</sub> level when using the SGC);
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

**Table 6**  
**Master Gradation Limits (% Passing by Weight or Volume) and Volumetric Requirements**

| Sieve Size  | Coarse (TOM-C)     | Fine (TOM-F)       |
|---|--------------------|--------------------|
| 1/2"  | 100.0 <sup>1</sup> | 100.0 <sup>1</sup> |
| 3/8"  | 95.0–100.0         | 98.0–100.0         |
| #4  | 40.0–60.0          | 70.0–95.0          |
| #8  | 17.0–27.0          | 40.0–65.0          |
| #16   | 5.0–27.0           | 20.0–45.0          |
| #30   | 5.0–27.0           | 10.0–35.0          |
| #50   | 5.0–27.0           | 10.0–20.0          |
| #200  | 5.0–9.0            | 2.0–12.0           |
| <b>Asphalt Binder Content,<sup>2</sup> % Min</b>          |                    |                    |
| -   | 6.0                | 6.5                |
| <b>Design VMA,<sup>3</sup> % Min</b>                      |                    |                    |
| -   | 16.0               | 16.5               |
| <b>Production (Plant-Produced) VMA,<sup>3</sup> % Min</b> |                    |                    |
| -   | 15.5               | 16.0               |

1. Defined as maximum sieve size. No tolerance allowed.
2. Unless otherwise shown on the plans or approved by the Engineer.
3. Voids in Mineral Aggregates (VMA).

**Table 7**  
**Mixture Design Properties**

| Mixture Property   | Test Method               | Requirement       |
|--|---------------------------|-------------------|
| Target laboratory-molded density, % (TGC)                          | <a href="#">Tex-207-F</a> | 97.5 <sup>1</sup> |
| Design gyrations (N <sub>design</sub> for SGC)                     | <a href="#">Tex-241-F</a> | 50 <sup>2</sup>   |
| Hamburg Wheel test, passes at 12.5 mm rut depth for PG 76 mixtures | <a href="#">Tex-242-F</a> | 20,000 Min        |
| Overlay test, Critical Fracture Energy, lb.-in/sq. in              | <a href="#">Tex-248-F</a> | 1.5 Min           |
| Overlay test, Crack Progression Rate                               | <a href="#">Tex-248-F</a> | 0.40 Max          |
| Drain-down, %  | <a href="#">Tex-235-F</a> | 0.20 Max          |

1. Unless otherwise shown on the plans or approved by the Engineer. Laboratory-molded density requirement using the TGC may be waived when approved by the Engineer.



2. May be adjusted within the range of 35–100 gyrations when shown on the plans or specification or when mutually agreed between the Engineer and Contractor. Laboratory-molded density requirement using the SGC may be waived when approved by the Engineer.

- 4.4.1 **Job-Mix Formula Approval.** The job-mix formula (JMF) is the combined aggregate gradation, target laboratory-molded density (or Ndesign level), and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When a compaction aid or foaming process is used, JMF1 may be designed and submitted to the Engineer without including the compaction aid or foaming process. When a compaction aid or foaming process is used, document the compaction aid or foaming process used and recommended rate on the JMF1 submittal. The Engineer and the Contractor will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. The Department may require the Contractor to reimburse the Department for verification tests if more than two trial batches per design are required.
- 4.4.2.1. **Contractor's Responsibilities.**
- 4.4.2.1.1. **Providing Gyrotory Compactor.** Use a TGC calibrated in accordance with [Tex-914-K](#) when electing or required to design the mixture in accordance with [Tex-204-E](#), Part I, for molding production samples. Furnish an SGC calibrated in accordance with [Tex-241-F](#) when electing or required to design the mixture in accordance with [Tex-204-F](#), Part IV, for molding production samples. Locate the SGC if used, at the Engineer's field laboratory or make the SGC available to the Engineer for use in molding production samples.
- 4.4.2.1.2. **Gyrotory Compactor Correlation Factors.** Use [Tex-206-F](#), Part II, to perform a gyrotory compactor correlation when the Engineer uses a different gyrotory compactor. Apply the correlation factor to all subsequent production test results.
- 4.4.2.1.3. **Submitting JMF1.** Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide approximately 25 lb. of the design mixture if opting to have the Department perform the Hamburg Wheel test on the laboratory mixture, and request that the Department perform the test. Provide approximately 60 lb. of the design mixture to perform the Overlay test.
- 4.4.2.1.4. **Supplying Aggregates.** Provide approximately 40 lb. of each aggregate stockpile unless otherwise directed.
- 4.4.2.1.5. **Supplying Asphalt.** Provide at least 1 gal. of the asphalt material and enough quantities of any additives proposed for use.
- 4.4.2.1.6. **Ignition Oven Correction Factors.** Determine the aggregate and asphalt correction factors from the ignition oven in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 mo. old. Provide the Engineer with split samples of the mixtures before the trial batch production, including all additives (except water), and blank samples used to determine the correction factors for the ignition oven used for QA testing during production. Correction factors established from a previously approved mixture design may be used for the current mixture design if the mixture design and ignition oven are the same as previously used and the correction factors are not more than 12 mo. old, unless otherwise directed.
- 4.4.2.1.7. **Boil Test.** When shown on the plans, perform the test and retain the tested sample from [Tex-530-C](#) until completion of the project or as directed. Use this sample for comparison purposes during production.
- 4.4.2.1.8. **Trial Batch Production.** Provide a plant-produced trial batch upon receiving conditional approval of JMF1 and authorization to produce a trial batch, including the compaction aid or foaming process, if applicable, for verification testing of JMF1 and development of JMF2. Produce a trial batch mixture that meets the requirements in accordance with Table 8. The Engineer may accept test results from recent production of the same mixture instead of a new trial batch.

- 4.4.2.1.9. **Trial Batch Production Equipment.** Use only equipment and materials proposed for use on the project to produce the trial batch.
- 4.4.2.1.10. **Trial Batch Quantity.** Produce enough quantity of the trial batch to ensure that the mixture meets the specification requirements.
- 4.4.2.1.11. **Number of Trial Batches.** Produce trial batches as necessary to obtain a mixture that meets the specification requirements.
- 4.4.2.1.12. **Trial Batch Sampling.** Obtain a representative sample of the trial batch and split it into three equal portions in accordance with [Tex-222-F](#). Label these portions as “Contractor,” “Engineer,” and “Referee.” Deliver samples to the appropriate laboratory as directed.
- 4.4.2.1.13. **Trial Batch Testing.** Test the trial batch to ensure the mixture produced using the proposed JMF1 meets the mixture requirements in accordance with Table 8. Ensure the trial batch mixture is also in compliance with the requirements in accordance with Tables 6 and 7. Use a Department-approved laboratory listed on the MPL to perform the Hamburg Wheel test on the trial batch mixture or request that the Department perform the Hamburg Wheel test. Provide approximately 25 lb. of the trial batch mixture if opting to have the Department perform the Hamburg Wheel test, and request that the Department perform the test. Obtain and provide approximately 60 lb. of trial batch mixture in sealed containers, boxes, or bags labeled with the CSJ, mixture type, lot, and subplot number in accordance with [Tex-222-F](#) for the Overlay test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test and Overlay test results on the trial batch. Provide the Engineer with a copy of the trial batch test results.
- 4.4.2.1.14. **Development of JMF2.** Evaluate the trial batch test results after the Engineer grants full approval of JMF 1 based on results from the trial batch, determine the optimum mixture proportions, and submit as JMF 2. Adjust the asphalt binder content or gradation to achieve the specified target laboratory-molded density. The mixture produced using JMF2 must meet the requirements in accordance with Tables 6 and 7. Verify that JMF2 meets the operation tolerances of JMF 1 in accordance with Table 8.
- 4.4.2.1.15. **Mixture Production.** Use JMF2 to produce Lot 1 after receiving approval for JMF2 and a passing result from the Department’s or a Department-approved laboratory’s Hamburg Wheel test and the Department’s Overlay test on the trial batch. If desired, proceed to Lot 1 production, once JMF2 is approved, at the Contractor’s risk without receiving the results from either the Department’s Hamburg Wheel test or Overlay test on the trial batch.
- Notify the Engineer if electing to proceed without Hamburg Wheel test and Overlay test results from the trial batch. Note that the Engineer may require up to the entire subplot of any mixture failing the Hamburg Wheel test or Overlay test to be removed and replaced at the Contractor’s expense.
- 4.4.2.1.16. **Development of JMF3.** Evaluate the test results from Lot 1, determine the optimum mixture proportions, and submit as JMF3 for use in Lot 2.
- 4.4.2.1.17. **JMF Adjustments.** If JMF adjustments are necessary to achieve the specified requirements, make the adjustments before beginning a new lot. The adjusted JMF must:
- be provided to the Engineer in writing before the start of a new lot;
  - be numbered in sequence to the previous JMF;
  - meet the master gradation limits in accordance with Table 6; and
  - be within the operational tolerances of JMF2 in accordance with Table 8.
- 4.4.2.1.18. **Requesting Referee Testing.** Use referee testing, if needed, in accordance with Section 3081.4.9.1., “Referee Testing,” to resolve testing differences with the Engineer.

**Table 8**  
**Operational Tolerances**

| Description   | Test Method  | Allowable Difference between JMF2 and JMF1 Target <sup>1</sup>  | Allowable Difference from Current JMF and JMF2 <sup>2</sup> | Allowable Difference between Contractor and Engineer <sup>3</sup> |
|---|--|---|---|---|
| Individual % retained for #8 sieve and larger                         | <a href="#">Tex-200-F</a><br>or<br><a href="#">Tex-236-F</a> | Must be Within Master Grading Limits in accordance with Table 6 | ±3.0 <sup>4,5</sup>   | ±5.0  |
| Individual % retained for sieves smaller than #8 and larger than #200 |  |   | ±3.0 <sup>4,5</sup>   | ±3.0  |
| % passing the #200 sieve  |  |   | ±2.0 <sup>4,5</sup>   | ±1.6  |
| Asphalt binder content, % <sup>6</sup>                                | <a href="#">Tex-236-F</a>                                    | ±0.3  | ±0.3 <sup>5</sup>   | ±0.3  |
| Laboratory-molded density, %  | <a href="#">Tex-207-F</a>                                    | ±1.0  | ±1.0  | ±1.0  |
| Laboratory-molded bulk specific gravity                               |  | N/A   | N/A   | ±0.020  |
| VMA, % Min  | <a href="#">Tex-204-F</a>                                    | Note 7  | Note 7  | N/A   |
| Theoretical Max specific (Rice) gravity                               | <a href="#">Tex-227-F</a>                                    | N/A   | N/A   | ±0.020  |
| Drain-down, %   | <a href="#">Tex-235-F</a>                                    | Note 8  | Note 8  | N/A   |

- JMF1 is the approved laboratory mixture design used for producing the trial batch. JMF2 is the approved mixture design developed from the trial batch used to produce Lot 1.
- Current JMF is JMF3 or higher. JMF3 is the approved mix design used to produce Lot 2.
- Contractor may request referee testing only when values exceed these tolerances.
- When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 will be considered out of tolerance when outside the master grading limits.
- Only applies to mixture produced for Lot 1 and higher.
- Binder content is not allowed to be outside the limits in accordance with Table 6. May be obtained from asphalt meter readouts as determined by the Engineer.
- Verify that Table 6 requirements are met.
- Verify that Table 7 requirements are met.

#### 4.4.2.2. **Engineer's Responsibilities.**

4.4.2.2.1. **Gyrotory Compactor.** For mixtures designed in accordance with [Tex-204-F](#), Part I, the Engineer will use a Department TGC, calibrated in accordance with [Tex-914-K](#), to mold samples for trial batch and production testing.

For mixtures designed in accordance with [Tex-204-F](#), Part IV, the Engineer will use a Department SGC, calibrated in accordance with [Tex-241-F](#), to mold samples for laboratory mixture design verification. For molding trial batch and production specimens, the Engineer will use the Contractor-provided SGC at the field laboratory or provide and use a Department SGC at an alternate location.

4.4.2.2.2. **Conditional Approval of JMF1 and Authorizing Trial Batch.** The Engineer will review and verify conformance of the following information within two working days of receipt

- the Contractor's mix design report (JMF1);
- the Department-provided Overlay test results;
- the Contractor-provided Hamburg Wheel test results;
- all required materials including aggregates, asphalt, and additives; and
- the mixture specifications.

The Engineer will grant the Contractor conditional approval of JMF1 if the information provided on the paper copy of JMF1 indicates that the Contractor's mixture design meets the specifications. When the Contractor does not provide Hamburg Wheel test and department provided Overlay test results with laboratory mixture design, 10 working days are allowed for conditional approval of JMF1. The Engineer will base full approval of JMF1 on test results on mixture from the trial batch.

Unless waived, the Engineer will determine the Micro-Deval abrasion loss in accordance with

Section 3081.2.1.1., "Micro-Deval Abrasion." If the Engineer's test results are pending after two working days, conditional approval of JMF1 will still be granted within two working days of receiving JMF1. When the Engineer's test results become available, they will be used for specification compliance.

The Contractor is authorized to produce a trial batch after the Engineer grants conditional approval of JMF1.

4.4.2.2.3. **Hamburg Wheel and Overlay Testing of JMF1.** If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the laboratory mixture, the Engineer will mold samples in accordance with [Tex-242-F](#) to verify compliance with the Hamburg Wheel test requirement in Table 7. The Engineer will perform the Overlay test and mold samples in accordance with [Tex-248-F](#) to verify compliance with the Overlay test requirements in Table 7. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel and Overlay test results on the laboratory mixture design.

4.4.2.2.4. **Ignition Oven Correction Factors.** The Engineer will use the split samples provided by the Contractor to determine the aggregate and asphalt correction factors for the ignition oven used for QA testing during production in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 mo. old.

4.4.2.2.5. **Testing the Trial Batch.** Within one full working day, the Engineer will sample and test the trial batch to ensure that the mixture meets the requirements in accordance with Table 8. The Engineer will mold samples in accordance with [Tex-242-F](#) if the Contractor requests the option to have the Department perform the Hamburg Wheel test on the trial batch mixture to verify compliance with Hamburg Wheel test requirements in Table 7. The Engineer will mold samples for the Overlay test in accordance with [Tex-248-F](#) to verify compliance with the Overlay test requirement in Table 7.

The Engineer will have the option to perform [Tex-530-C](#) on the trial batch when shown on the plans. These results may be retained and used for comparison purposes during production.

4.4.2.2.6. **Full Approval of JMF1.** The Engineer will grant full approval of JMF1 and authorize the Contractor to proceed with developing JMF2 if the Engineer's results for the trial batch meet the requirements in accordance with Tables 6 and 7. The Engineer will notify the Contractor that an additional trial batch is required if the trial batch does not meet these requirements.

4.4.2.2.7. **Approval of JMF2.** The Engineer will approve JMF2 within one working day if the mixture meets the requirements in accordance with Table 6, 7, and 8.

4.4.2.2.8. **Approval of Lot 1 Production.** The Engineer will authorize the Contractor to proceed with Lot 1 production (using JMF2) as soon as a passing result is achieved from the Department's or a Department-approved laboratory's Hamburg Wheel test and the Department's Overlay test on the trial batch. The Contractor may proceed at its own risk with Lot 1 production without the results from the Hamburg Wheel test or Overlay test on the trial batch.

If the Department's or Department-approved laboratory's sample from the trial batch fails the Hamburg Wheel test or Overlay test, the Engineer will suspend production until further Hamburg Wheel tests or Overlay tests meet the specified values. The Engineer may require up to the entire subplot of any mixture failing the Hamburg Wheel test or Overlay test to be removed and replaced at the Contractor's expense.

4.4.2.2.9. **Approval of JMF3 and Subsequent JMF Changes.** JMF3 and subsequent JMF changes are approved if they meet the master grading limits and asphalt binder content shown in Table 6 and are within the operational tolerances of JMF2 shown in accordance with Table 8.

4.5. **Production Operations.** Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification.

4.5.1. **Storage and Heating of Materials.** Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.

4.5.2. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed the maximum production temperatures in accordance with Table 9. The Department will not pay for or allow placement of any mixture produced above the maximum production temperatures listed in Table 9.

**Table 9  
Maximum Production Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Max Production Temperature |
|--|----------------------------|
| PG 76                                      | 345°F                      |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. Determine the moisture content, if requested, by oven-drying in accordance with [Tex-212-F](#), Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck and perform the test promptly.

4.6. **Hauling Operations.** Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent shown on the Department's MPL to coat the inside bed of the truck when necessary. Do not use diesel or any release agent not shown on the Department's MPL.

Use equipment for hauling as defined in Section 3081.4.7.3.3., "Hauling Equipment." Use other hauling equipment only when allowed.

4.7. **Placement Operations.** Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour, or as directed. Use a hand-held thermal camera or infrared thermometer, when a thermal imaging system is not used, to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Place mixture so that longitudinal joints on the surface course coincide within 6-in. of lane lines and are not placed in the wheel path, or as directed, and offset longitudinal joints of successive courses of hot-mix by at least 6-in. Ensure that all finished surfaces will drain properly. Place the mixture at the rate or thickness shown on the plans. The Engineer will use the guidelines in Table 10 to determine the compacted lift thickness. The thickness determined is based on the rate of 110–115 lb. per square inch. for each inch of pavement unless otherwise shown on the plans.

**Table 10  
Compacted Lift Thickness**

| Mixture Type | Compacted Lift Thickness <sup>1</sup> |           |
|--------------|---------------------------------------|-----------|
|              | Min (in.)                             | Max (in.) |
| TOM-C        | 0.75                                  | 1.25      |
| TOM-F        | 0.5                                   | 1.00      |

1. Compacted target lift thickness will be specified on the plans.

4.7.1. **Weather Conditions.**

4.7.1.1. **When Using a Thermal Imaging System.** The Contractor may pave any time the roadway is dry and the roadway surface temperature is at least 60°F unless otherwise approved or as shown on the plans; however, the Engineer may restrict the Contractor from paving surface mixtures if the ambient temperature is likely to drop below 32°F within 12 hr. of paving. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. Provide output data from the thermal imaging system to demonstrate to the Engineer that no recurring severe thermal segregation exists in accordance with Section 3081.4.7.3.1.2., "Thermal Imaging System."

Produce mixture with a target discharge temperature higher than 300°F and with a compaction aid to facilitate compaction when the air temperature is 70°F and falling

4.7.1.2. **When Not Using a Thermal Imaging System.** When using a thermal camera instead the thermal imaging system, place mixture when the roadway surface temperature is at or above 70°F unless otherwise approved or as shown on the plans. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the air temperature is 70°F and falling.

Produce mixture with a target discharge temperature higher than 300°F and with a compaction aid to facilitate compaction when the air temperature is 70°F and falling.

4.7.2. **Tack Coat.**

4.7.2.1. **Application.** Clean the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area, unless otherwise specified on the plans. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns. Apply the tack coat to all surfaces that will come in contact with the subsequent HMA placement unless otherwise directed. Apply adequate overlap of the tack coat in the longitudinal direction during placement of the mat to ensure bond of adjacent mats, unless otherwise directed. Allow adequate time for emulsion to break completely before placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. The Engineer may suspend paving operations until there is adequate coverage. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

4.7.2.2. **Sampling.** The Engineer will obtain at least one sample of the tack coat binder per project in accordance with [Tex-500-C](#), Part III, and test it to verify compliance with Item 300, "Asphalts, Oils, and Emulsions." The Engineer will notify the Contractor when the sampling will occur and will witness the collection of the sample from the asphalt distributor immediately before use. Label the can with the corresponding lot and subplot numbers, producer, producer facility, grade, district, date sampled, and project information including highway and CSJ. For emulsions, the Engineer may test as often as necessary to ensure the residual of the emulsion is greater than or equal to the specification requirement in Item 300, "Asphalts, Oils, and Emulsions."

4.7.3. **Lay-Down Operations.** Use the placement temperatures in accordance with Table 11 to establish the minimum placement temperature of mixture delivered to the paving operation.

**Table 11**  
**Minimum Mixture Placement Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Min Placement Temperature<br>(Before Entering Paving Operation) <sup>2,3</sup> |
|--|--|
| PG 76                                      | 280°F  |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. The mixture temperature must be measured using a hand-held thermal camera or infrared thermometer nearest to the point of entry of the paving operation.
3. Minimum placement temperatures may be reduced 10°F if using a compaction aid.

4.7.3.1. **Thermal Profile.** Use a hand-held thermal camera or a thermal imaging system to obtain a continuous thermal profile in accordance with [Tex-244-F](#).

4.7.3.1.1. **Thermal Segregation.**

4.7.3.1.1.1. **Moderate.** Any areas that have a temperature differential greater than 25°F, but not exceeding 50°F.

4.7.3.1.1.2. **Severe.** Any areas that have a temperature differential greater than 50°F.

4.7.3.1.2. **Thermal Imaging System.** Review the output results when a thermal imaging system is used, and provide the report described in accordance with [Tex-244-F](#) to the Engineer daily. Modify the paving process as necessary to eliminate any recurring (moderate or severe) thermal segregation identified by the thermal imaging system.

The Engineer may suspend subsequent paving operations if the Contractor cannot successfully modify the paving process to eliminate recurring severe or moderate thermal segregation.

Provide the Engineer with electronic copies of all daily data files that can be used with the thermal imaging system software to generate temperature profile plots daily or as requested by the Engineer.

4.7.3.1.3. **Thermal Camera.** When using a thermal camera instead of the thermal imaging system, take immediate corrective action to eliminate recurring moderate thermal segregation when a hand-held thermal camera is used. Evaluate areas with moderate thermal segregation by performing water flow testing in accordance with [Tex-246-F](#) and verify the water flow is greater than 120 sec. Provide the Engineer with the thermal profile of every subplot within one working day of the completion of each lot. When requested by the Engineer, provide the electronic files generated using the thermal camera. Report the results of each thermal profile in accordance with Section 3081.4.2., "Reporting and Responsibilities." The Engineer will use a hand-held thermal camera to obtain a thermal profile at least once per project, unless the thermal imaging system is used. Suspend operations and take immediate corrective action to eliminate severe thermal segregation unless otherwise directed. Resume operations when the Engineer determines that subsequent production will meet the requirements of this Section. Evaluate areas with severe thermal segregation by performing water flow testing in accordance with [Tex-246-F](#) and verify the water flow is greater than 120 sec. Remove and replace the material in any areas that have both severe thermal segregation and a failing result for water flow test unless otherwise directed.

4.7.3.2. **Windrow Operations.** Operate windrow pickup equipment so that when hot-mix is placed in windrows, substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

4.7.3.3. **Hauling Equipment.** Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture. End dump trucks are only allowed when used in conjunction with an MTD with remixing capability unless otherwise allowed.

4.7.3.4. **Screed Heaters.** Turn off screed heaters to prevent overheating of the mat if the paver stops for more than 5 min. The Engineer may evaluate the suspect area in accordance with Section 3081.4.9.3.1.1., "Recovered Asphalt Dynamic Shear Rheometer (DSR)," if the screed heater remains on for more than 5 min. while the paver is stopped.

4.8.

**Compaction.** Roll the freshly placed mixture with as many steel-wheeled rollers as necessary to ensure adequate compaction without excessive breakage of the aggregate and to provide a smooth surface and uniform texture. Operate each roller in static mode for TOM-F mixtures only. Do not use pneumatic-tire rollers. Use the control strip method given in accordance with [Tex-207-F](#), Part IV, to establish the rolling pattern. Thoroughly moisten the roller drums with a soap and water solution to prevent adhesion. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.

Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

Use [Tex-246-F](#) to measure water flow to verify the mixture is adequately compacted. Measure the water flow once per subplot at locations directed by the Engineer. Take additional water flow measurements when the minimum temperature of the uncompacted mat is below the temperature requirements in accordance with Table 12.

**Table 12**  
**Minimum Uncompacted Mat Temperature Requiring Additional Water Flow Measurements**

| High-Temperature Binder Grade <sup>1</sup> | Min Temperature of the Uncompacted Mat Allowed Before Initial Break Down Rolling <sup>2,3</sup> |
|--|---|
| PG 76                                      | <270°F  |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. The surface of the uncompacted mat must be measured using a hand-held thermometer or infrared thermometer.
3. Minimum uncompacted mat temperature requiring a water flow measurement may be reduced 10°F if using a compaction aid.

Use [Tex-246-F](#) to measure water flow to verify the mixture is adequately compacted at confined longitudinal joints as directed by the Engineer.

The water flow rate should be greater than 120 sec. Investigate the cause of the water flow rate test failures and take corrective actions during production and placement to ensure the water flow rate is greater than 120 sec. Suspend production if two consecutive water flow rate tests fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

Complete all compaction operations before the pavement temperature drops below 180°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 180°F when approved.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

4.9.

**Acceptance Plan.** Sample and test the hot-mix asphalt on a lot and subplot basis.

4.9.1.

**Referee Testing.** The Materials and Tests Division is the referee laboratory. The Contractor may request referee testing if the differences between Contractor and Engineer test results exceed the maximum allowable difference in accordance with Table 8 and the differences cannot be resolved. The Contractor may also request referee testing if the Engineer's test results require suspension of production and the Contractor's test results are within specification limits. Make the request within five working days after receiving test results from the Engineer. Referee tests will be performed only on the subplot in question and only for the particular tests in question. Allow 10 working days from the time the referee laboratory receives the samples for test results to be reported. The Department may require the Contractor to reimburse the Department for referee tests if more than three referee tests per project are required and the Engineer's test results are closer to the referee test results than the Contractor's test results.

The Materials and Tests Division will determine the laboratory-molded density based on the molded specific gravity and the maximum theoretical specific gravity of the referee sample.



#### 4.9.2. **Production Acceptance.**

4.9.2.1. **Production Lot.** A production lot consists of four equal sublots. The default quantity for Lot 1 is 500 ton; however, when requested by the Contractor, the Engineer may increase the quantity for Lot 1 to no more than 2,000 ton. The Engineer will select subsequent lot sizes based on the anticipated daily production such that approximately three to four sublots are produced each day. The lot size will be between 500 ton and 2,000 ton. The Engineer may change the lot size before the Contractor begins any lot.

4.9.2.1.1. **Incomplete Production Lots.** If a lot is begun but cannot be completed, such as on the last day of production or in other circumstances deemed appropriate, the Engineer may close the lot. Close all lots within five working days unless otherwise allowed.

#### 4.9.2.2. **Production Sampling.**

4.9.2.2.1. **Mixture Sampling.** Obtain hot-mix samples from trucks at the plant in accordance with [Tex-222-F](#). The sampler will split each sample into three equal portions in accordance with [Tex-200-F](#) and label these portions as “Contractor,” “Engineer,” and “Referee.” The Engineer will perform or witness the sample splitting and take immediate possession of the samples labeled “Engineer” and “Referee.” The Engineer will maintain the custody of the samples labeled “Engineer” and “Referee” until the Department’s testing is completed.

4.9.2.2.1.1. **Random Sample.** At the beginning of the project, the Engineer will select random numbers for all production sublots. Determine sample locations in accordance with [Tex-225-F](#). Take one sample for each subplot at the randomly selected location. The Engineer will perform or witness the sampling of production sublots.

4.9.2.2.1.2. **Blind Sample.** For one subplot per lot, the Engineer will obtain and test a “blind” sample instead of the random sample collected by the Contractor. Test either the “blind” or the random sample; however, referee testing (if applicable) will be based on a comparison of results from the “blind” sample. The location of the Engineer’s “blind” sample will not be disclosed to the Contractor. The Engineer’s “blind” sample may be randomly selected in accordance with [Tex-225-F](#) for any subplot or selected at the discretion of the Engineer. The Engineer will use the Contractor’s split sample for sublots not sampled by the Engineer.

4.9.2.2.2. **Informational Methylene Blue Testing.** During the project and at random, obtain and provide the Engineer with approximately 50 lb. of each fine aggregate and approximately 20 lb. of all mineral fillers used to produce the mixture. Label the samples with the Control Section Job (CSJ), mixture type, and approximate lot and subplot number corresponding to when the sample was taken. The Engineer will ship the samples to the Materials and Tests Division for Methylene Blue testing in accordance with [Tex-252-F](#). Results from these tests will not be used for specification compliance.

4.9.2.2.3. **Asphalt Binder Sampling.** Obtain a 1-qt. sample of the asphalt binder witnessed by the Engineer for each lot of mixture produced. The Contractor will notify the Engineer when the sampling will occur. Obtain the sample at approximately the same time the mixture random sample is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill and upstream from the introduction of any additives in accordance with [Tex-500-C](#), Part II. Label the can with the corresponding lot and subplot numbers, producer, producer facility location, grade, district, date sampled, and project information including highway and CSJ. The Engineer will retain these samples for one year. The Engineer may also obtain independent samples. If obtaining an independent asphalt binder sample and upon request of the Contractor, the Engineer will split a sample of the asphalt binder with the Contractor.

At least once per project, the Engineer will collect split samples of each binder grade and source used. The Engineer will submit one split sample to the Materials and Tests Division to verify compliance with Item 300, “Asphalts, Oils, and Emulsions,” and will retain the other split sample for 1 yr.

4.9.2.3. **Production Testing.** The Contractor and Engineer must perform production tests in accordance with Table 13. The Contractor has the option to verify the Engineer’s test results on split samples provided by the Engineer. Determine compliance with operational tolerances listed in accordance with Table 8 for all sublots. Take immediate corrective action if the Engineer’s laboratory-molded density on any subplot is less than 95.0% or greater than 98.0% when using the SGC or less than 96.5% or greater than 98.5% when using the TGC, to bring

the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

The Engineer may allow alternate methods for determining the asphalt binder content and aggregate gradation if the aggregate mineralogy is such that [Tex-236-F](#), Part I does not yield reliable results. Provide evidence that results from [Tex-236-F](#), Part I are not reliable before requesting permission to use an alternate method unless otherwise directed. Use the applicable test procedure as directed if an alternate test method is allowed.

**Table 13**  
**Production and Placement Testing Frequency**

| Description   | Test Method  | Min Contractor Testing               | Min Engineer Testing          |
|---|--|--------------------------------------|-------------------------------|
| Individual % retained for #8 sieve and larger                         | <a href="#">Tex-200-F</a><br>or<br><a href="#">Tex-236-F</a> | 1 per subplot                        | 1 per 12 sublots <sup>1</sup> |
| Individual % retained for sieves smaller than #8 and larger than #200 |  |                                      |                               |
| % passing the #200 sieve  |  |                                      |                               |
| Laboratory-molded density   | <a href="#">Tex-207-F</a>                                    | N/A                                  | 1 per subplot <sup>1</sup>    |
| Laboratory-molded bulk specific gravity                               |  |                                      |                               |
| VMA   |  |                                      |                               |
| Moisture content  | <a href="#">Tex-212-F</a> , Part II                          | When directed                        |                               |
| Theoretical maximum specific (Rice) gravity                           | <a href="#">Tex-227-F</a> , Part II                          | N/A                                  | 1 per subplot <sup>1</sup>    |
| Asphalt binder content <sup>2</sup>                                   | <a href="#">Tex-236-F</a> , Part I                           | 1 per subplot                        | 1 per lot <sup>1</sup>        |
| Overlay test <sup>3</sup>   | <a href="#">Tex-248-F</a>                                    | N/A                                  | 1 per project                 |
| Hamburg Wheel test  | <a href="#">Tex-242-F</a>                                    | N/A                                  | 1 per project                 |
| Thermal profile   | <a href="#">Tex-244-F</a>                                    | 1 per subplot <sup>4,5,6</sup>       | 1 per project <sup>5</sup>    |
| Asphalt binder sampling and testing                                   | <a href="#">Tex-500-C</a> , Part II                          | 1 per lot (sample only) <sup>7</sup> | 1 per project                 |
| Tack coat sampling and testing  | <a href="#">Tex-500-C</a> , Part III                         | N/A                                  | 1 per project                 |
| Boil test <sup>8</sup>  | <a href="#">Tex-530-C</a>                                    | 1 per subplot <sup>9</sup>           | 1 per project                 |
| Water flow  | <a href="#">Tex-246-F</a>                                    |                                      |                               |
| Methylene blue test <sup>10</sup>                                     | <a href="#">Tex-252-F</a>                                    | 1 per project (sample only)          | 1 per project                 |

1. For production defined in Section 3081.4.9.4., "Exempt Production," the Engineer will test one per day if 100 ton or more are produced. For Exempt Production, no testing is required with less than 100 ton are produced.
2. May be obtained from asphalt flow meter readout as determined by the Engineer.
3. Testing performed by the Materials and Tests Division on sample obtained from Lot 2 or higher.
4. To be performed in the presence of the Engineer when a thermal camera is used, unless otherwise approved.
5. Not required when a thermal imaging system is used.
6. When using the thermal imaging system, the test report must include the temperature measurements taken in accordance with [Tex-244-F](#).
7. Obtain samples witnessed by the Engineer. The Engineer will retain these samples for 1 yr.
8. When shown on the plans.
9. To be performed in the presence of the Engineer, unless otherwise directed.
10. Testing performed by the Materials and Tests Division for informational purposes only.

4.9.2.4. **Operational Tolerances.** Control the production process within the operational tolerances in accordance with Table 8. When production is suspended, the Engineer will allow production to resume when test results or other information indicates the next mixture produced will be within the operational tolerances.

4.9.2.4.1. **Gradation.** Suspend operation and take corrective action if any aggregate is retained on the maximum sieve size in accordance with Table 6. A subplot is defined as out of tolerance if either the Engineer's or the Contractor's test results are out of operational tolerance. Suspend production when test results for gradation exceed the operational tolerances in accordance with Table 8 for three consecutive sublots on the same sieve or four consecutive sublots on any sieve unless otherwise directed. The consecutive sublots may be from more than one lot.

4.9.2.4.2. **Asphalt Binder Content.** A subplot is defined as out of operational tolerance if either the Engineer's or the Contractor's test results exceed the values in accordance with Table 8. Suspend production when two or

more sublots within a lot are out of operational tolerance or below the minimum asphalt binder content specified in accordance with Table 6 unless otherwise directed. Suspend production and shipment of mixture if the Engineer's or Contractor's asphalt binder content deviates from the current JMF by more than 0.5% for any subplot or is less than the minimum asphalt content allowed in accordance with Table 6.

- 4.9.2.4.3. **Voids in Mineral Aggregates (VMA).** The Engineer will determine the VMA for every subplot. For sublots when the Engineer does not determine asphalt binder content, the Engineer will use the asphalt binder content results from QC testing performed by the Contractor to determine VMA.

Take immediate corrective action if the VMA value for any subplot is less than the minimum VMA requirement for production in accordance with Table 6. Suspend production and shipment of the mixture if the Engineer's VMA results on two consecutive sublots are below the minimum VMA requirement for production in accordance with Table 6.

Suspend production and shipment of the mixture if the Engineer's VMA result is more than 0.5% below the minimum VMA requirement for production in accordance with Table 6. In addition to suspending production, the Engineer may require removal and replacement or may allow the subplot to be left in place without payment.

- 4.9.2.4.4. **Hamburg Wheel.** The Engineer may perform a Hamburg Wheel on plant produced mixture at any time during production. In addition to testing production samples, the Engineer may obtain cores and perform the Hamburg Wheel test on any area of the roadway where rutting is observed. Suspend production until further Hamburg Wheel meet the specified values when the production or core samples fail to meet the Hamburg Wheel criteria in accordance with Table 7. Core samples, if taken, will be obtained from the center of the finished mat or other areas excluding the vehicle wheel paths. The Engineer may require up to the entire subplot of any mixture failing the Hamburg Wheel to be removed and replaced at the Contractor's expense.

If the Department's or Department-approved laboratory's Hamburg Wheel test results in a "remove and replace" condition, the Contractor may request that the Department confirm the results by re-testing the failing material. The Materials and Tests Division will perform the Hamburg Wheel and determine the final disposition of the material in question based on the Department's test results.

- 4.9.2.5. **Individual Loads of Hot-Mix.** The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances in accordance with Table 8, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.

- 4.9.3. **Placement Acceptance.**

- 4.9.3.1. **Placement Lot.** A placement lot consists of four placement sublots. A placement subplot consists of the area placed during a production subplot.

- 4.9.3.1.1. **Recovered Asphalt Dynamic Shear Rheometer (DSR).** The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Materials and Tests Division. The aging ratio is the DSR value of the extracted binder divided by the DSR value of the original unaged binder. Obtain DSR values in accordance with AASHTO T 315 at the specified high temperature performance grade of the asphalt. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores in accordance with [Tex-211-F](#).

- 4.9.3.1.2. **Irregularities.** Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. The Engineer may require the Contractor to remove and replace (at the

Contractor's expense) areas of the pavement that contain irregularities if the Engineer determines that the irregularity will adversely affect pavement performance. The Engineer may also require the Contractor to remove and replace (at the Contractor's expense) areas where the mixture does not bond to the existing pavement.

The Engineer may require the Contractor to immediately suspend operations if irregularities are detected or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.

4.9.4. **Exempt Production.** When the anticipated daily production is less than 100 ton, all QC and QA sampling and testing are waived. The Engineer may deem the mixture as exempt production for the following conditions:

- anticipated daily production is more than 100 ton but less than 250 ton;
- total production for the project is less than 2,500 ton;
- when mutually agreed between the Engineer and the Contractor; or
- when shown on the plans.

For exempt production, the Contractor is relieved of all production and placement sampling and testing requirements. All other specification requirements apply, and the Engineer will perform acceptance tests for production and placement in accordance with Table 13.

For exempt production:

- produce, haul, place, and compact the mixture as directed by the Engineer; and
- control mixture production to yield a laboratory-molded density that is within  $\pm 1.0\%$  of the target density as tested by the Engineer.

4.9.5. **Ride Quality.** Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

## 5. MEASUREMENT

5.1. **TOM Hot-Mix Asphalt.** TOM hot-mix will be measured by the ton of composite mixture, which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."

5.2. **Tack Coat.** Tack coat will be measured at the applied temperature by strapping the tank before and after road application and determining the net volume in gallons from the calibrated distributor. The Engineer will witness all strapping operations for volume determination. All tack, including emulsions, will be measured by the gallon applied.

The Engineer may allow the use of a metering device to determine asphalt volume used and application rate if the device is accurate within 1.5% of the strapped volume.

## 6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under Section 3081.5.1., "TOM Hot-Mix Asphalt," will be paid for at the unit bid price for "Thin Overlay Mixture" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, removing pavement marking and markers, materials, placement, equipment, labor, tools, and incidentals.

The work performed and materials furnished in accordance with this Item and measured as provided under Section 3081.5.2., "Tack Coat," will be paid for at the unit bid price for "Tack Coat" of the tack coat provided. These prices are full compensation for materials, placement, equipment, labor, tools, and incidentals.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."

# Special Specification 3082

## Thin Bonded Friction Courses



### 1. DESCRIPTION

Construct a hot-mix asphalt (HMA) surface course composed of a warm spray-applied polymer modified emulsion membrane followed immediately with a compacted permeable mixture of aggregate, asphalt binder, and additives mixed hot in a mixing plant.

### 2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

2.1. **Aggregate.** Furnish aggregates from sources that conform to the requirements shown in Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse or fine aggregate. Do not use intermediate or fine aggregate in PFC mixtures. Supply aggregates that meet the definitions in [Tex-100-E](#) for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in accordance with Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in [Tex-200-F](#), Part II.

2.1.1. **Coarse Aggregate.** Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance;
- approved only when tested by the Engineer;
- once approved, do not add material to the stockpile unless otherwise approved; and
- allow 30 calendar days for the Engineer to sample, test, and report results.

Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes, unless otherwise shown on the plans. SAC requirements apply to aggregates used on surfaces other than travel lanes when shown on the plans. The SAC for sources on the Department's *Aggregate Quality Monitoring Program* (AQMP) ([Tex-499-A](#)) is listed in the BRSQC.

- 2.1.1.1. **Blending Class A and Class B Aggregates.** To prevent crushing of the Class B aggregate when blending, Class B aggregate may be blended with a Class A aggregate to meet requirements for Class A materials if the Department's BRSQC rated source soundness magnesium (RSSM) rating for the Class B aggregate is less than the Class A aggregate or if the RSSM rating for the Class B aggregate is less than or equal to 10%. Use the rated values for hot mix asphaltic concrete (HMAC) published in the BRSQC. When blending Class A and B aggregates to meet a Class A requirement, ensure that at least 50% by weight, or volume if required, of all the aggregates used in the mixture design retained on the No. 4 sieve comes from the Class A aggregate source, unless otherwise shown on the plans. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. Class B aggregate may be disallowed when shown on the plans.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 4 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

- 2.1.1.2. **Micro-Deval Abrasion.** The Engineer will perform a minimum of one Micro-Deval abrasion test in accordance with [Tex-461-A](#) for each coarse aggregate source used in the mixture design that has a Rated Source Soundness Magnesium (RSSM) loss value greater than 15 as listed in the BRSQC, unless otherwise directed. The Engineer will perform testing before the start of production and may perform additional testing at any time during production. The Engineer may obtain the coarse aggregate samples from each coarse aggregate source or may require the Contractor to obtain the samples. The Engineer may waive all Micro-Deval testing based on a satisfactory test history of the same aggregate source.

The Engineer will estimate the magnesium sulfate soundness loss for each coarse aggregate source, when tested, using the following formula:

$$Mg_{est.} = (RSSM)(MD_{act.}/RSMD)$$

where:

$Mg_{est.}$  = magnesium sulfate soundness loss

$RSSM$  = Rated Source Soundness Magnesium

$MD_{act.}$  = actual Micro-Deval percent loss

$RSMD$  = Rated Source Micro-Deval

When the estimated magnesium sulfate soundness loss is greater than the maximum magnesium sulfate soundness loss specified, the coarse aggregate source will not be allowed for use unless otherwise approved. The Engineer will consult the Soils and Aggregates Section of the Materials and Tests Division, and additional testing may be required before granting approval.

- 2.1.2. **Fine Aggregate.** Fine aggregates consist of manufactured sands and screenings. Fine aggregate stockpiles must meet the fine aggregate properties in accordance with Table 1 and the gradation requirements in accordance with Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with [Tex-408-A](#) to verify the material is free from organic impurities. Do not use field sand or other uncrushed fine aggregate. Use fine aggregate from coarse aggregate sources that meet the requirements shown in accordance with Table 1 unless otherwise approved.

**Table 1**  
**Coarse Aggregate Quality Requirements**

| Property                                      | Test Method                        | Requirement           |
|---|------------------------------------|-----------------------|
| SAC   | <a href="#">Tex-499-A (AQMP)</a>   | As shown on the plans |
| Deleterious material, %, Max                  | <a href="#">Tex-217-E, Part I</a>  | 1.0                   |
| Decantation, %, Max                           | <a href="#">Tex-217-E, Part II</a> | 1.5                   |
| Micro-Deval abrasion, %                       | <a href="#">Tex-461-A</a>          | Note <sup>1</sup>     |
| Los Angeles abrasion, %, Max                  | <a href="#">Tex-410-A</a>          | 30                    |
| Magnesium sulfate soundness, 5 cycles, %, Max | <a href="#">Tex-411-A</a>          | 20                    |
| Crushed face count <sup>2</sup> , %, Min      | <a href="#">Tex-460-A, Part I</a>  | 95                    |
| Flat and elongated particles @ 5:1, %, Max    | <a href="#">Tex-280-F</a>          | 10                    |
| Fine Aggregate Properties                     |                                    |                       |
| Sand Equivalent, %, Min                       | <a href="#">Tex-203-F</a>          | 45                    |
| Methylene Blue, mg/g, Max                     | <a href="#">Tex-252-F</a>          | 10.0                  |

- Used to estimate the magnesium sulfate soundness loss in accordance with section 3082.2.1.1.2., "Micro-Deval Abrasion."
- Only applies to crushed gravel.

**Table 2**  
**Gradation Requirements for Fine Aggregate**

| Sieve Size | % Passing by Weight or Volume |
|------------|-------------------------------|
| 3/8"       | 100                           |
| #8         | 70–100                        |
| #200       | 0–30                          |

- 2.2. **Mineral Filler.** Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, or hydrated lime. Fly ash is not allowed unless otherwise shown on the plans. Mineral filler is allowed unless otherwise shown on the plans. Use no more than 2% hydrated lime, unless otherwise shown on the plans. Test all mineral fillers except hydrated lime and fly ash in accordance with [Tex-252-F](#) to ensure specification compliance. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:
- is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
  - does not exceed 3% linear shrinkage when tested in accordance with [Tex-107-E](#); and
  - meets the gradation requirements in accordance with Table 3, unless otherwise shown on the plans.

**Table 3**  
**Gradation Requirements for Mineral Filler**

| Sieve Size | % Passing by Weight or Volume |
|------------|-------------------------------|
| #8         | 100                           |
| #200       | 55–100                        |

- 2.3. **Baghouse Fines.** Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.
- 2.4. **Asphalt Binder.** Furnish the type and grade of binder specified on the plans that meets the requirements of Item 300, "Asphalts, Oils, and Emulsions."
- 2.4.1. **Performance-Graded (PG) Binder.** Provide an asphalt binder with a high-temperature grade of PG 76 and low-temperature grade as shown on the plans in accordance with Section 300.2.10., "Performance-Graded Binders," when PG binder is specified.
- 2.4.2. **Asphalt-Rubber (A-R) Binder.** Provide A-R binder that meets the Type I or Type II requirements of Section 300.2.9., "Asphalt-Rubber Binders," when A-R is specified unless otherwise shown on the plans. Use at least 15.0% by weight of Crumb Rubber Modifier (CRM) that meets the Grade B or Grade C requirements of Section 300.2.7., "Crumb Rubber Modifier," unless otherwise shown on the plans. Provide the Engineer the A-R binder blend design with the mix design (JMF1) submittal. Provide the Engineer with documentation such as the bill of lading showing the quantity of CRM used in the project unless otherwise directed.
- 2.5. **Membrane.** Provide a smooth and homogeneous polymer modified emulsion meeting the requirements in accordance with Table 4.



**Table 4**  
**Polymer Modified Emulsion Requirements**

| Test on Emulsion  | Test Method               | Min | Max  |
|---|---------------------------|-----|------|
| Viscosity @ 77°F, SSF   | T 72                      | 20  | 100  |
| Storage Stability, <sup>1</sup> %   | T 59                      |     | 1    |
| Demulsibility (for anionic emulsions), 35 mL of 0.02 N CaCl <sub>2</sub> , %        | T 59                      | 55  |      |
| Demulsibility (for cationic emulsions), 35 mL 0.8% Sodium dioctyl sulfosuccinate, % | T 59                      | 55  |      |
| Sieve Test, <sup>2</sup> %  | T 59                      |     | 0.05 |
| Distillation Test: <sup>3</sup>   |                           |     |      |
| Residue by distillation, % by wt.   | T 59                      | 63  | 0.5  |
| Oil portion of distillate, % by vol.  |                           |     |      |
| Test on Residue from Distillation   | Test Method               | Min | Max  |
| Elastic Recovery @ 50°F, 50 mm/min., %  | <a href="#">Tex-539-C</a> | 60  |      |
| Penetration @ 77°F, 100 g, 5 sec, 0.1 mm  | T 49                      | 100 | 150  |

1. After standing undisturbed for 24 hr., the surface must be smooth, must not exhibit a white or milky colored substance, and must be a homogeneous color throughout.
2. May be required by the Engineer only when the emulsion cannot be easily applied in the field.
3. The temperature on the lower thermometer should be brought slowly to 350°F ±10°F and maintained at this temperature for 20 min. The total distillation should be complete in 60 ±5 min. from the first application of heat.

2.6. **Additives.** Provide the Engineer with documentation such as the bill of lading showing the quantity of additives used in the project unless otherwise directed.

2.6.1. **Fibers.** Provide cellulose or mineral fibers when PG binder is specified. Do not use fibers when A-R binder is specified. Submit written certification to the Engineer that the fibers proposed for use meet the requirements of DMS-9204, "Fiber Additives for Bituminous Mixtures." Fibers may be pre-blended into the binder at the asphalt supply terminal unless otherwise shown on the plans.

2.6.2. **Lime Mineral Filler.** Add lime as mineral filler at a rate of 1.0% by weight of the total dry aggregate in accordance with Item 301, "Asphalt Antistripping Agents," unless otherwise shown on the plans or waived by the Engineer based on Hamburg Wheel test results. Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.

2.6.3. **Lime and Liquid Antistripping Agent.** When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum. Lime added as mineral filler will count towards the total quantity of lime specified when the plans require lime to be added as an antistripping agent.

2.6.4. **Compaction Aid.** Compaction Aid is defined as a Department-approved chemical warm mix additive denoted as "chemical additive" on the Department's material producer list (MPL) that is used to facilitate mixing and compaction of HMA.

Compaction aid is allowed for use on all projects. Compaction aid is required when shown on the plans or as required in Section 3082.4.7.1., "Weather Conditions."

Warm mix foaming processes, denoted as "foaming process" on the Department-approved MPL, may be used to facilitate mixing and compaction of HMA; however warm mix processes are not defined as a Compaction Aid.

2.7. **Recycled Materials.** Recycled materials are not allowed for use.

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### 3. EQUIPMENT

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement." When A-R binder is specified, equip the hot-mix plant with an in-line viscosity-measuring device located between the blending unit and the mixing drum. Provide a means to calibrate the asphalt mass flow meter on-site when a meter is used.

3.1. **Placement Equipment.** Provide a paver that meets all the requirements listed below.

3.1.1. **Paver.** Furnish a paver that will spray the membrane, apply the PFC mixture, and level the surface of the mat in a single pass. Configure the paver so that the mixture is placed no more than 5 sec. after the membrane is applied. Ensure the paver does not support the weight of any portion of hauling equipment other than the connection. Provide loading equipment that does not transmit vibrations or other motions to the paver that adversely affects the finished pavement quality. Equip the paver with an automatic dual longitudinal-grade control system and an automatic transverse-grade control system.

3.1.1.1. **Tractor Unit.** Supply a tractor unit that can push or propel vehicles, dumping directly into the finishing machine to obtain the desired lines and grades to eliminate any hand finishing. Equip the unit with a hitch to maintain contact between the hauling equipment's rear wheels and the finishing machine's pusher rollers while mixture is unloaded.

3.1.1.2. **Membrane Storage Tank and Distribution System.** Equip the paver with an insulated storage tank with a minimum capacity of 900 gal. Provide a metered mechanical pressure sprayer on the paver to apply a uniform membrane at the specified rate. Locate the spray bar on the paver so that the membrane is applied immediately in front of the screed unit. Provide a read-out device on the paver to monitor the membrane application rate.

Furnish a volumetric calibration and strap stick for the tank in accordance with [Tex-922-K](#), Part I, unless otherwise directed. Calibrate the tank within the previous 5 yr. of the date first used on the project. The Engineer may verify calibration accuracy in accordance with [Tex-922-K](#), Part II.

3.1.1.3. **Screed.** Provide a variable width vibratory screed that meets Item 320, "Equipment for Asphalt Concrete Pavement."

3.1.2. **Material Transfer Device (MTD).** Provide the specified type of MTD when shown on the plans. Ensure MTDs provide a continuous, uniform mixture flow to the asphalt paver.

3.1.3. **Rollers.** Provide steel-wheel rollers meeting the requirements of Item 210, "Rolling," except provide rollers weighing a minimum of 10 ton for each roller required. Operate rollers in static (non-vibrating) mode unless otherwise allowed.

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### 4. CONSTRUCTION

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a mandatory pre-paving meeting with the Engineer on or before the first day of paving unless otherwise shown on the plans.

4.1. **Certification.** Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 5. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist. Provide Level 1A certified specialists at the plant during production operations. Provide Level 1B certified specialists to conduct placement tests. Provide AGG101 certified specialists for aggregate testing.

**Table 5**  
**Test Methods, Test Responsibility, and Minimum Certification Levels**

| Test Description                                  | Test Method                                     | Contractor | Engineer | Level <sup>1</sup> |
|---|---|------------|----------|--------------------|
| <b>1. Aggregate Testing</b>                       |   |            |          |                    |
| Sampling  | <a href="#">Tex-221-F</a>                       | ✓          | ✓        | 1A/AGG101          |
| Dry sieve   | <a href="#">Tex-200-F</a> , Part I              | ✓          | ✓        | 1A/AGG101          |
| Washed sieve                                      | <a href="#">Tex-200-F</a> , Part II             | ✓          | ✓        | 1A/AGG101          |
| Deleterious material                              | <a href="#">Tex-217-F</a> , Parts I & III       | ✓          | ✓        | AGG101             |
| Decantation                                       | <a href="#">Tex-217-F</a> , Part II             | ✓          | ✓        | AGG101             |
| Los Angeles abrasion                              | <a href="#">Tex-410-A</a>                       |            | ✓        | Department         |
| Magnesium sulfate soundness                       | <a href="#">Tex-411-A</a>                       |            | ✓        | Department         |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                       |            | ✓        | AGG101             |
| Crushed face count                                | <a href="#">Tex-460-A</a>                       | ✓          | ✓        | AGG101             |
| Flat and elongated particles                      | <a href="#">Tex-280-F</a>                       | ✓          | ✓        | AGG101             |
| Methylene blue test                               | <a href="#">Tex-252-F</a>                       |            | ✓        | Department         |
| <b>2. Asphalt Binder &amp; Tack Coat Sampling</b> |   |            |          |                    |
| Asphalt binder sampling                           | <a href="#">Tex-500-C</a> , Part II             | ✓          | ✓        | 1A/1B              |
| Membrane sampling                                 | <a href="#">Tex-500-C</a> , Part III            | ✓          | ✓        | 1A/1B              |
| <b>3. Mix Design &amp; Verification</b>           |   |            |          |                    |
| Design and JMF changes                            | <a href="#">Tex-204-F</a>                       | ✓          | ✓        | 2                  |
| Mixing  | <a href="#">Tex-205-F</a>                       | ✓          | ✓        | 2                  |
| Molding (SGC)                                     | <a href="#">Tex-241-F</a>                       | ✓          | ✓        | 1A                 |
| Laboratory-molded density                         | <a href="#">Tex-207-F</a> , Parts I, VI, & VIII | ✓          | ✓        | 1A                 |
| Rice gravity                                      | <a href="#">Tex-227-F</a> , Part II             | ✓          | ✓        | 1A                 |
| Ignition oven correction factors <sup>2</sup>     | <a href="#">Tex-236-F</a> , Part II             | ✓          | ✓        | 2                  |
| Drain-down  | <a href="#">Tex-235-F</a>                       | ✓          | ✓        | 1A                 |
| Hamburg Wheel test                                | <a href="#">Tex-242-F</a>                       | ✓          | ✓        | 1A                 |
| Boil test <sup>4</sup>                            | <a href="#">Tex-530-C</a>                       | ✓          | ✓        | 1A                 |
| Cantabro loss                                     | <a href="#">Tex-245-F</a>                       | ✓          | ✓        | 1A                 |
| <b>4. Production Testing</b>                      |   |            |          |                    |
| Control charts                                    | <a href="#">Tex-233-F</a>                       | ✓          | ✓        | 1A                 |
| Mixture sampling                                  | <a href="#">Tex-222-F</a>                       | ✓          | ✓        | 1A/1B              |
| Gradation & asphalt binder content <sup>2</sup>   | <a href="#">Tex-236-F</a> , Part I              | ✓          | ✓        | 1A                 |
| Moisture content                                  | <a href="#">Tex-212-F</a> , Part II             | ✓          | ✓        | 1A/AGG101          |
| Micro-Deval abrasion                              | <a href="#">Tex-461-A</a>                       |            | ✓        | AGG101             |
| Drain-down  | <a href="#">Tex-235-F</a>                       | ✓          | ✓        | 1A                 |
| Boil test <sup>4</sup>                            | <a href="#">Tex-530-C</a>                       | ✓          | ✓        | 1A                 |
| Abson recovery                                    | <a href="#">Tex-211-F</a>                       |            | ✓        | Department         |
| <b>5. Placement Testing</b>                       |   |            |          |                    |
| Control charts                                    | <a href="#">Tex-233-F</a>                       | ✓          | ✓        | 1A                 |
| Ride quality measurement                          | <a href="#">Tex-1001-S</a>                      | ✓          | ✓        | Note 3             |
| Thermal profile                                   | <a href="#">Tex-244-F</a>                       | ✓          | ✓        | 1B                 |
| Water flow test                                   | <a href="#">Tex-246-F</a>                       | ✓          | ✓        | 1B                 |

1. Level 1A, 1B, AGG101, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.
2. Refer to Section 3082.4.5., "Production Operations," for exceptions to using an ignition oven.
3. Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.
4. When shown on the plans.

4.2.

**Reporting and Responsibilities.** Use Department-provided templates to record and calculate all test data, including mixture design, production and placement tests, control charts, and thermal profiles. Obtain the current version of the templates at <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html> or from the Engineer. The Engineer and the Contractor will provide any available test results to the other party when requested. The Contractor and Engineer must exchange test data within the maximum allowable time in accordance with Table 6 unless otherwise approved. The Engineer and the

Contractor will immediately report to the other party any test result that requires suspension of production or placement or that fails to meet the specification requirements. Record and electronically submit all test results and pertinent information on Department-provided templates.

Subsequent sublots placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Section 5.3., "Conformity with Plans, Specifications, and Special Provisions."

**Table 6**  
**Reporting Schedule**

| Description                            | Reported By | Reported To | To Be Reported Within                      |
|--|-------------|-------------|--|
| <b>Production Quality Control</b>      |             |             |  |
| Gradation <sup>1</sup>                 | Contractor  | Engineer    | 1 working day of completion of the subplot |
| Asphalt binder content <sup>1</sup>    |             |             |  |
| Laboratory-molded density <sup>1</sup> |             |             |  |
| Moisture content <sup>2</sup>          |             |             |  |
| Drain-down <sup>1</sup>                |             |             |  |
| Boil test <sup>4</sup>                 |             |             |  |
| <b>Production Quality Assurance</b>    |             |             |  |
| Gradation <sup>2</sup>                 | Engineer    | Contractor  | 1 working day of completion of the subplot |
| Asphalt binder content <sup>2</sup>    |             |             |  |
| Laboratory-molded density <sup>2</sup> |             |             |  |
| Hamburg Wheel test <sup>3</sup>        |             |             |  |
| Boil test <sup>4</sup>                 |             |             |  |
| Drain-down <sup>2</sup>                |             |             |  |
| Binder tests <sup>3</sup>              |             |             |  |
| <b>Placement Quality Control</b>       |             |             |  |
| Thermal profile <sup>1</sup>           | Contractor  | Engineer    | 1 working day of completion of the lot     |
| Water flow <sup>1</sup>                |             |             |  |
| Membrane application rate <sup>2</sup> |             |             |  |
| <b>Placement Quality Assurance</b>     |             |             |  |
| Thermal profile <sup>2</sup>           | Engineer    | Contractor  | 1 working day of completion of the lot     |
| Aging ratio <sup>3</sup>               |             |             |  |
| Water flow <sup>2</sup>                |             |             |  |
| Membrane application rate <sup>2</sup> |             |             |  |

1. These tests are required on every subplot.
2. To be performed at the frequency in accordance with Table 14 or as shown on the plans.
3. To be reported as soon as the results become available.
4. When shown on the plans

Use the procedures described in [Tex-233-F](#), when directed, to plot the results of all production and placement testing. Update the control charts as soon as test results for each subplot become available. Make the control charts readily accessible at the field laboratory. The Engineer may suspend production for failure to update control charts.

- 4.3. **Quality Control Plan (QCP).** Develop and follow the QCP in detail. Obtain approval for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Submit a written QCP before the mandatory pre-paving meeting, when directed. Receive approval of the QCP before pre-paving meeting. Include the following items in the QCP:

- 4.3.1. **Project Personnel.** For project personnel, include:
- a list of individuals responsible for QC with authority to take corrective action;
  - current contact information for each individual listed; and
  - current copies of certification documents for individuals performing specified QC functions.
- 4.3.2. **Material Delivery and Storage.** For material delivery and storage, include:
- the sequence of material processing, delivery, and minimum quantities to assure continuous plant

operations;

- aggregate stockpiling procedures to avoid contamination and segregation;
- frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
- procedure for monitoring the quality and variability of asphalt binder.

4.3.3. **Production.** For production, include:

- loader operation procedures to avoid contamination in cold bins;
- procedures for calibrating and controlling cold feeds;
- procedures to eliminate debris or oversized material;
- procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, lime, liquid antistripping, compaction aid, foaming process, fibers);
- procedures for reporting job control test results; and
- procedures to avoid segregation and drain-down in the silo.

4.3.4. **Loading and Transporting.** For loading and transporting, include:

- type and application method for release agents; and
- truck loading procedures to avoid segregation.

4.3.5. **Placement and Compaction.** For placement and compaction, include:

- proposed agenda for mandatory pre-paving meeting, including date and location;
- proposed paving plan (e.g., production rate, paving widths, joint offsets, and lift thicknesses);
- type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
- procedures for the transfer of mixture into the paver while avoiding physical and thermal segregation and preventing material spillage;
- process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality;
- paver operations (e.g., speed, operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
- procedures to construct quality longitudinal and transverse joints.

4.4. **Mixture Design.**

4.4.1. **Design Requirements.** Use the design procedure provided in [Tex-204-F](#), unless otherwise shown on the plans. Design the mixture to meet the requirements in accordance with Tables 1, 2, 3, 7, 8, and 9. Use a Superpave Gyration Compactor (SGC) at 50 gyrations as the design number of gyrations (Ndesign).

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF1) before the Contractor can begin production.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- the membrane application rate based on design volumetrics;
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

**Table 7**  
**Master Gradation Limits (% Passing by Weight or Volume)**  
**and Laboratory Mixture Design Properties**

| Sieve Size | Permeable Friction Course |                           | Thin Bonded Friction Course |                  |                  |
|------------|---------------------------|---------------------------|-----------------------------|------------------|------------------|
|            | Fine (PFC-F)              | Coarse (PFC-C and PFCR-C) | Type A                      | Type B           | Type C           |
| 3/4"       | –                         | 100.0 <sup>1</sup>        | –                           | –                | 100 <sup>1</sup> |
| 1/2"       | 100.0 <sup>1</sup>        | 80.0–100.0                | –                           | 100 <sup>1</sup> | 75–100           |
| 3/8"       | 95.0–100.0                | 35.0–60.0                 | 100 <sup>1</sup>            | 75–100           | 55–80            |
| #4         | 20.0–55.0                 | 1.0–20.0                  | 35–55                       | 22–36            | 22–36            |
| #8         | 1.0–10.0                  | 1.0–10.0                  | 19–30                       | 19–30            | 19–30            |
| #16        | –                         | –                         | 14–25                       | 14–24            | 14–24            |
| #50        | –                         | –                         | 7–14                        | 7–14             | 7–14             |
| #200       | 1.0–4.0                   | 1.0–4.0                   | 4–6                         | 4–6              | 4–6              |

1. Defined as maximum sieve size. No tolerance allowed.

**Table 8**  
**Mixture Design Properties**

| Mixture Property   | Test Method               | PG 76 Mixtures   |                  | A-R Mixtures    | Thin Bonded Friction Course |          |          |
|--|---------------------------|------------------|------------------|-----------------|-----------------------------|----------|----------|
|  |                           | Fine (PFC-F)     | Coarse (PFC-C)   | Coarse (PFCR-C) | Type A                      | Type B   | Type C   |
| Asphalt binder content, %                                    | –                         | 6.0–7.0          | 6.0–7.0          | 7.0–9.0         | 5.0–5.8                     | 4.8–5.6  | 4.8–5.6  |
| Film thickness, microns                                      | –                         | –                | –                | –               | 9.0 Min                     | 9.0 Min  | 9.0 Min  |
| Design gyrations (Ndesign)                                   | <a href="#">Tex-241-F</a> | 50               | 50               | 50              | 50                          | 50       | 50       |
| Laboratory-molded density, %                                 | <a href="#">Tex-207-F</a> | 78.0 Max         | 82.0 Max         | 82.0 Max        | 92.0 Max                    | 92.0 Max | 92.0 Max |
| Hamburg Wheel test, <sup>1</sup> passes at 12.5 mm rut depth | <a href="#">Tex-242-F</a> | 10,000 Min       | Note 2           | Note 2          | Note 2                      | Note 2   | Note 2   |
| Drain-down, %  | <a href="#">Tex-235-F</a> | 0.10 Max         | 0.10 Max         | 0.10 Max        | 0.10 Max                    | 0.10 Max | 0.10 Max |
| Fiber content, % by wt. of total PG 76 mixture               | Calculated                | 0.20–0.50        | 0.20–0.50        | –               | –                           | –        | –        |
| Lime content, % by wt. of total aggregate                    | Calculated                | 1.0 <sup>3</sup> | 1.0 <sup>3</sup> | –               | Note 4                      | Note 4   | Note 4   |
| CRM content, % by wt. of A-R binder                          | Calculated                | –                | –                | 15.0 Min        | –                           | –        | –        |
| Boil test <sup>5</sup>                                       | <a href="#">Tex-530-C</a> | –                | –                | –               | –                           | –        | –        |
| Cantabro loss, %   | <a href="#">Tex-245-F</a> | 20.0 Max         | 20.0 Max         | 20.0 Max        | 20.0 Max                    | 20.0 Max | 20.0 Max |

1. Mold test specimens to Ndesign at the optimum asphalt binder content.
2. No specification value is required unless otherwise shown on the plans.
3. Unless otherwise shown on the plans or waived by the Engineer based on Hamburg Wheel results.
4. Lime may be required when shown on the plans.
5. When shown on the plans. Used to establish baseline for comparison to production results.

4.4.2. **Job-Mix Formula Approval.** The job-mix formula (JMF) is the combined aggregate gradation, Ndesign level, and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When a compaction aid or foaming process is used, JMF1 may be designed and submitted to the Engineer without including the compaction aid or foaming process. When a compaction aid or foaming process is used, document the compaction aid or foaming process used and recommended rate on the JMF1 submittal. The Engineer and the Contractor will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. The Department may require the Contractor to reimburse the Department for verification tests if more than two trial batches per design are required.

4.4.2.1. **Contractor's Responsibilities.**

4.4.2.1.1. **Providing Superpave Gyratory Compactor.** Furnish an SGC calibrated in accordance with [Tex-241-F](#) for molding production samples. Locate the SGC at the Engineer's field laboratory or make the SGC available to the Engineer for use in molding production samples.

4.4.2.1.2. **Gyratory Compactor Correlation Factors.** Use [Tex-206-F](#), Part II, to perform a gyratory compactor

correlation when the Engineer uses a different SGC. Apply the correlation factor to all subsequent production test results.

- 4.4.2.1.3. **Submitting JMF1.** Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide an additional 25 lb. of the design mixture if opting to have the Department perform the Hamburg Wheel test on the laboratory mixture when required in accordance with Table 8, and request that the Department perform the test.
- 4.4.2.1.4. **Supplying Aggregates.** Provide approximately 40 lb. of each aggregate stockpile unless otherwise directed.
- 4.4.2.1.5. **Supplying Asphalt.** Provide at least 1 gal. of the asphalt material and enough quantities of any additives proposed for use.
- 4.4.2.1.6. **Ignition Oven Correction Factors.** Determine the aggregate and asphalt correction factors from the ignition oven in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 mo. old. Note that the asphalt content correction factor takes into account the percent fibers in the mixture so that the fibers are excluded from the binder content determination. Provide the Engineer with split samples of the mixtures before the trial batch production, including all additives (except water), and blank samples used to determine the correction factors for the ignition oven used for quality assurance testing during production. Correction factors established from a previously approved mixture design may be used for the current mixture design if the mixture design and ignition oven are the same as previously used and the correction factors are not more than 12 mo. old, unless otherwise directed.
- 4.4.2.1.7. **Boil Test.** When shown on the plans, perform the test and retain the tested sample from [Tex-530-C](#) until completion of the project or as directed. Use this sample for comparison purposes during production. Add lime or liquid antistripping agent as directed if signs of stripping exist.
- 4.4.2.1.8. **Trial Batch Production.** Provide a plant-produced trial batch upon receiving conditional approval of JMF1 and authorization to produce a trial batch, including the compaction aid or foaming process, if applicable, for verification testing of JMF1 and development of JMF2. Produce a trial batch mixture that meets the requirements in accordance with Table 9. The Engineer may accept test results from recent production of the same mixture instead of a new trial batch.
- 4.4.2.1.9. **Trial Batch Production Equipment.** Use only equipment and materials proposed for use on the project to produce the trial batch. Provide documentation to verify the calibration or accuracy of the asphalt mass flow meter to measure the binder content. Verify that asphalt mass flow meter meets the requirements of 0.4 % accuracy, when required, in accordance with Item 520, "Weighing and Measuring Equipment." The Engineer may require that the accuracy of the mass flow meter be verified based on quantities used.
- 4.4.2.1.10. **Trial Batch Quantity.** Produce enough quantity of the trial batch to ensure that the mixture meets the specification requirements.
- 4.4.2.1.11. **Number of Trial Batches.** Produce trial batches as necessary to obtain a mixture that meets the specification requirements.
- 4.4.2.1.12. **Trial Batch Sampling.** Obtain a representative sample of the trial batch and split it into three equal portions in accordance with [Tex-222-F](#). Label these portions as "Contractor," "Engineer," and "Referee." Deliver samples to the appropriate laboratory as directed.
- 4.4.2.1.13. **Trial Batch Testing.** Test the trial batch to ensure the mixture produced using the proposed JMF1 meets the mixture requirements in accordance with Table 9. Ensure the trial batch mixture is also in compliance with the requirements in accordance with Tables 7 and 8. Use a Department-approved laboratory listed on the MPL to perform the Hamburg Wheel test on the trial batch mixture or request that the Department perform the Hamburg Wheel test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the trial batch. Provide the Engineer with a copy of the trial batch test results.
- 4.4.2.1.14. **Development of JMF2.** Evaluate the trial batch test results, determine the target mixture proportions, and

submit as JMF2 after the Engineer grants full approval of JMF1 based on results from the trial batch. Verify that JMF2 meets the mixture requirements in accordance with Table 9.

- 4.4.2.1.15. **Mixture Production.** After receiving approval for JMF2, use JMF2 to produce Lot 1.
- 4.4.2.1.16. **Development of JMF3.** Evaluate the test results from Lot 1, determine the optimum mixture proportions, and submit as JMF3 for use in Lot 2.
- 4.4.2.1.17. **JMF Adjustments.** If JMF adjustments are necessary to achieve the specified requirements, make the adjustments before beginning a new lot. The adjusted JMF must:
- be provided to the Engineer in writing before the start of a new lot;
  - be numbered in sequence to the previous JMF;
  - meet the master gradation limits in accordance with Table 7
  - meet the binder content limits in accordance with Table 8; and
  - be within the operational tolerances of JMF2 in accordance with Table 9.
- 4.4.2.1.18. **Requesting Referee Testing.** Use referee testing, if needed, in accordance with Section 3082.4.9.1., "Referee Testing," to resolve testing differences with the Engineer.

**Table 9**  
**Operational Tolerances**

| Test Description                                       | Test Method                                     | Allowable Difference between JMF2 and JMF1 Target <sup>1</sup>  | Allowable Difference from Current JMF and JMF2 <sup>2</sup> | Allowable Difference between Contractor and Engineer <sup>3</sup> |
|--|---|---|---|---|
| Individual % retained for sieve sized larger than #200 | <a href="#">Tex-200-F</a>                       | Must be Within Master Grading Limits in accordance with Table 7 | ±3.0 <sup>4</sup>   | ±5.0 <sup>4</sup>   |
| % passing the #200 sieve                               |   |   | ±2.0 <sup>4</sup>   | ±3.0 <sup>4</sup>   |
| Laboratory-molded density, %                           | <a href="#">Tex-207-F</a> , Part VIII           | ±1.0  | ±1.0  | ±1.0  |
| Asphalt binder content, %                              | <a href="#">Tex-236-F</a> , Part I <sup>5</sup> | ±0.3 <sup>6,7</sup>   | ±0.3 <sup>4,6,7</sup>                                       | ±0.3 <sup>6,7</sup>   |
| Drain-down, %  | <a href="#">Tex-235-F</a>                       | Note 8  | Note 8  | N/A   |
| Boil test  | <a href="#">Tex-530-C</a>                       | Note 9  | Note 9  | N/A   |
| Membrane application rate                              | <a href="#">Tex-247-F</a>                       | ±0.02   | ±0.02   | N/A   |

1. JMF1 is the approved laboratory mixture design used for producing the trial batch. JMF2 is the approved mixture design developed from the trial batch used to produce Lot 1.
2. Current JMF is JMF3 or higher. JMF3 is the approved mixture design used to produce Lot 2.
3. Contractor may request referee testing only when values exceed these tolerances.
4. Only applies to mixture produced for Lot 1 and higher. Aggregate gradation is not allowed to be outside the limits in accordance with Table 7.
5. Ensure the binder content determination excludes fibers.
6. May be obtained from asphalt mass flow meter readouts as determined by the Engineer.
7. Binder content is not allowed to be outside the limits shown in Table 8.
8. Verify that Table 8 requirements are met.
9. When shown on the plans.

- 4.4.2.2. **Engineer's Responsibilities.**
- 4.4.2.2.1. **Superpave Gyratory Compactor.** The Engineer will use a Department SGC calibrated in accordance with [Tex-241-F](#) to mold samples for laboratory mixture design verification. For molding trial batch and production specimens, the Engineer will use the Contractor-provided SGC at the field laboratory or provide and use a Department SGC at an alternate location.
- 4.4.2.2.2. **Conditional Approval of JMF1 and Authorizing Trial Batch.** The Engineer will review and verify conformance of the following information within two working days of receipt:



- the Contractor's mix design report (JMF1);
- the Contractor-provided Hamburg Wheel test results, if applicable;
- all required materials including aggregates, asphalt, and additives; and
- the mixture specifications.

The Engineer will grant the Contractor conditional approval of JMF1 if the information provided on the paper copy of JMF1 indicates that the Contractor's mixture design meets the specifications. When the Contractor does not provide Hamburg Wheel test with laboratory mixture design, 10 working days are allowed for conditional approval of JMF1. The Engineer will base full approval of JMF1 on the test results on mixture from the trial batch.

Unless waived, the Engineer will determine the Micro-Deval abrasion loss in accordance with

Section 3082.2.1.1.2., "Micro-Deval Abrasion." If the Engineer's test results are pending after two working days, conditional approval of JMF1 will still be granted within two working days of receiving JMF1. When the Engineer's test results become available, they will be used for specification compliance.

The Contractor is authorized to produce a trial batch after the Engineer grants conditional approval of JMF1.

4.4.2.2.3. **Hamburg Wheel Testing.** At the Contractor's request, the Department will perform the Hamburg Wheel test on the laboratory mixture in accordance with [Tex-242-F](#) to verify compliance with the Hamburg Wheel test requirement in accordance with Table 8. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel results on the laboratory mixture design.

4.4.2.2.4. **Ignition Oven Correction Factors.** The Engineer will use the split samples provided by the Contractor to determine the aggregate and asphalt correction factors for the ignition oven used for quality assurance testing during production in accordance with [Tex-236-F](#), Part II. Provide correction factors that are not more than 12 mo. old. The Engineer will verify that the asphalt content correction factor takes into account the percent fibers in the mixture so that the fibers are excluded from the binder content determination.

4.4.2.2.5. **Testing the Trial Batch.** The Engineer will sample and test the trial batch within one full working day to ensure that the mixture meets the requirements in accordance with Table 9. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the trial batch mixture, the Engineer will mold samples in accordance with [Tex-242-F](#) to verify compliance with the Hamburg Wheel test requirement in accordance with Table 8.

The Engineer will have the option to perform [Tex-530-C](#) on the trial batch when shown on the plans. These results may be retained and used for comparison purposes during production.

4.4.2.2.6. **Full Approval of JMF1.** The Engineer will grant full approval of JMF1 and authorize the Contractor to proceed with developing JMF2 if the Engineer's results for the trial batch meet the requirements in accordance with Tables 7 and 8.

The Engineer will notify the Contractor that an additional trial batch is required if the trial batch does not meet these requirements.

4.4.2.2.7. **Approval of JMF2.** The Engineer will approve JMF2 within one working day if the mixture meets the requirements in accordance with Tables 7, 8, and 9.

4.4.2.2.8. **Approval of Lot 1 Production.** The Engineer will authorize the Contractor to proceed with Lot 1 production (using JMF2).

4.4.2.2.9. **Approval of JMF3 and Subsequent JMF Changes.** JMF3 and subsequent JMF changes are approved if they meet the master grading and asphalt binder content shown in accordance with Tables 7 and 8 and are within the operational tolerances of JMF2 in accordance with Table 9.

- 4.4.2.2.10. **Binder Content Adjustments.** For JMF2 and above, the Engineer may require the Contractor to adjust the target binder content by no more than 0.3% from the current JMF.
- 4.5. **Production Operations.** Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification.
- 4.5.1. **Storage and Heating of Materials.** Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.
- 4.5.2. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed the maximum production temperatures in accordance with Table 10. The Department will not pay for or allow placement of any mixture produced above the maximum production temperatures in accordance with Table 10.

**Table 10**  
**Maximum Production Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Max Production Temperature |
|--|----------------------------|
| PG 76                                      | 345°F                      |
| A-R Binder                                 | 345°F                      |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. Determine the moisture content, if requested, by oven-drying in accordance with [Tex-212-F](#), Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck and perform the test promptly.

- 4.6. **Hauling Operations.** Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent shown on the Department's MPL to coat the inside bed of the truck when necessary. Do not use diesel or any release agent not shown on the Department's MPL.
- Use equipment for hauling as defined in Section 3082.4.7.3.2., "Hauling Equipment." Use other hauling equipment only when allowed.
- 4.7. **Placement Operations.** Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour, or as directed. Use a hand-held thermal camera or infrared thermometer, when a thermal imaging system is not used, to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Do not allow any loose mixture onto the prepared surface before application of the membrane. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot-mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide within 6-in. of lane lines and are not placed in the wheel path, or as directed, and offset longitudinal joints of successive courses of hot-mix by at least 6-in. Ensure that all finished surfaces will drain properly.

4.7.1. **Weather Conditions.**

4.7.1.1. **When Using a Thermal Imaging System.** The Contractor may pave any time the roadway is dry and the roadway surface temperature is at least 60°F unless otherwise approved or as shown on the plans; however, the Engineer may restrict the Contractor from paving if the ambient temperature is likely to drop below 32°F within 12 hr. of paving. Place mixtures when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. Provide output data from the thermal imaging system to demonstrate to the Engineer that no recurring severe thermal segregation exists in accordance with Section 3082.4.7.3.1.2., "Thermal Imaging System."

Produce mixture with a target discharge temperature higher than 300°F and with a compaction aid to facilitate compaction when the air temperature is 70°F and falling.

4.7.1.2. **When Not Using a Thermal Imaging System.** When using a thermal camera instead of the thermal imaging system, place mixture when the roadway surface temperature is at or above 70°F unless otherwise approved or as shown on the plans. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the air temperature is 60°F and falling.

Produce mixture with a target discharge temperature higher than 300°F and with a compaction aid to facilitate compaction when the air temperature is 70°F and falling.

4.7.2. **Application of Membrane.** Apply the membrane at the rates in accordance with Table 11 unless otherwise directed. Spray the membrane using a metered mechanical pressure spray bar at a temperature of 140°F to 180°F. Monitor the membrane application rate and make adjustments to the rate when directed. Verify that the spray bar is capable of applying the membrane at a uniform rate across the entire paving width. Apply adequate overlap of the tack coat in the longitudinal direction during placement of the mat to ensure bond of adjacent mats, unless otherwise directed. Unless otherwise directed, avoid tacking the vertical faces of adjacent PFC mats in the longitudinal direction to avoid restricting lateral drainage. Apply tack coat to all transverse joints. Do not let the wheels or other parts of the paving machine contact the freshly applied membrane. Do not dilute the membrane at the terminal, in the field, or at any other location before use. Do not allow any loose mixture onto the prepared surface before application of the membrane.

**Table 11**  
**Membrane Application Rate Limits, (Gal. per square yard)**

| Mix Type                    | Lift Thickness | Membrane Rate |
|-----------------------------|----------------|---------------|
| Permeable Friction Course   | 1-1/2 in.      | 0.30–0.33     |
|                             | 1-1/4 in.      | 0.27–0.30     |
|                             | 1 in.          | 0.25–0.28     |
|                             | 3/4 in.        | 0.22–0.25     |
| Thin Bonded Friction Course | 3/4 in.        | 0.17–0.27     |
|                             | 5/8 in.        | 0.16–0.24     |
|                             | 1/2 in.        | 0.14–0.20     |

4.7.2.1. **Non-uniform Application of Membrane.** Stop application if it is not uniform due to streaking, ridging, pooling, or flowing off the roadway surface. Verify equipment condition including plugged nozzles on the spray bar, operating procedures, application temperature, and material properties. Determine and correct the cause of non-uniform application.

4.7.2.2. **Test Strips.** The Engineer may perform independent tests to confirm Contractor compliance and may require testing differences or failing results to be resolved before resuming production.

The Engineer may cease operations and require construction of test strips at the Contractor's expense if any of the following occurs:

- non-uniformity of application continues after corrective action;
- in three consecutive shots, application rate differs by more than 0.03 gal. per square yard from the rate

- directed; or
- any shot differs by more than 0.05 gal. per square yard from the rate directed.

The Engineer will approve the test strip location. The Engineer may require additional test strips until the membrane application meets specification requirements.

- 4.7.3. **Lay-Down Operations.** Use the placement temperature in accordance with Table 12 to establish the minimum placement temperature of the mixture delivered to the paving operation.

**Table 12**  
**Min Mixture Placement Temperature**

| High-Temperature Binder Grade <sup>1</sup> | Min Placement Temperature<br>(Before Entering Paving Operation) <sup>2,3</sup> |
|--|--|
| PG 76                                      | 280°F  |
| A-R Binder                                 | 280°F  |

1. The high-temperature binder grade refers to the high-temperature grade of the virgin asphalt binder used to produce the mixture.
2. The mixture temperature must be measured using a hand-held thermal camera or infrared thermometer nearest to the point of entry of the paving operation.
3. Minimum placement temperatures may be reduced 10°F if using a compaction aid.

- 4.7.3.1. **Thermal Profile.** Use a hand-held thermal camera or a thermal imaging system to obtain a continuous thermal profile in accordance with [Tex-244-F](#). Thermal profiles are not applicable in areas described in Section 3082.4.9.8., "Miscellaneous Areas."

- 4.7.3.1.1. **Thermal Segregation.**

- 4.7.3.1.1.1. **Moderate.** Any areas that have a temperature differential greater than 25°F, but not exceeding 50°F.

- 4.7.3.1.1.2. **Severe.** Any areas that have a temperature differential greater than 50°F.

- 4.7.3.1.2. **Thermal Imaging System.** Review the output results when a thermal imaging system is used, and provide the report described in [Tex-244-F](#) to the Engineer daily unless otherwise directed. Modify the paving process as necessary to eliminate any recurring (moderate or severe) thermal segregation identified by the thermal imaging system.

The Engineer may suspend subsequent paving operations if the Contractor cannot successfully modify the paving process to eliminate recurring severe or moderate thermal segregation.

Provide the Engineer with electronic copies of all daily data files that can be used with the thermal imaging system software to generate temperature profile plots daily or as requested by the Engineer.

- 4.7.3.1.3. **Thermal Camera.** When using the thermal camera instead of the thermal imaging system, take immediate corrective action to eliminate recurring moderate thermal segregation when a hand-held thermal camera is used. Provide the Engineer with the thermal profile of every subplot within one working day of the completion of each lot. When requested by the Engineer, provide the electronic files generated using the thermal camera. Report the results of each thermal profile in accordance with Section 3082.4.2., "Reporting and Responsibilities." The Engineer will use a hand-held thermal camera to obtain a thermal profile at least once per project unless the thermal imaging system is used. Suspend operations and take immediate corrective action to eliminate severe thermal segregation unless otherwise directed. Resume operations when the Engineer determines that subsequent production will meet the requirements of this Section.

- 4.7.3.2. **Hauling Equipment.** Use live bottom or end dump trucks to haul and transfer mixture; however, with exception of paving miscellaneous areas, end dump trucks are only allowed when used in conjunction with an MTD with remixing capability or when a thermal imaging system is used unless otherwise allowed.

- 4.7.3.3. **Screed Heaters.** Turn off screed heaters to prevent overheating of the mat if the paver stops for more than 5 min. The Engineer may evaluate the suspect area in accordance with Section 3082.4.9.9., "Recovered

Asphalt Dynamic Shear Rheometer (DSR),” if the screed heater remains on for more than 5 min. while the paver is stopped.

- 4.8. **Compaction.** Roll the freshly placed mixture with as many steel-wheeled rollers as necessary, operated in static mode, to seat the mixture without excessive breakage of the aggregate and to provide a smooth surface and uniform texture. Do not use pneumatic rollers. Use the control strip method given in [Tex-207-F](#), Part IV, to establish the rolling pattern. Moisten the roller drums thoroughly with a soap and water solution to prevent adhesion. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.

For PFC mixtures, use [Tex-246-F](#) to test and verify that the compacted mixture has adequate permeability. Measure the water flow once per subplot at locations directed by the Engineer. The water flow rate should be less than 20 sec. Investigate the cause of the water flow rate test failures and take corrective actions during production and placement to ensure the water flow rate is less than 20 sec. Suspend production if two consecutive water flow rate tests fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

Complete all compaction operations before the pavement temperature drops below 180°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 180°F.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

- 4.9. **Acceptance Plan.** Sample and test the hot-mix on a lot and subplot basis.
- 4.9.1. **Referee Testing.** The Materials and Tests Division is the referee laboratory. The Contractor may request referee testing if the differences between Contractor and Engineer test results exceed the operational tolerances in accordance with Table 9 and the differences cannot be resolved. The Contractor may also request referee testing if the Engineer’s test results require suspension of production and the Contractor’s test results are within specification limits. Make the request within five working days after receiving test results and cores from the Engineer. Referee tests will be performed only on the subplot in question and only for the particular tests in question. Allow 10 working days from the time the referee laboratory receives the samples for test results to be reported. The Department may require the Contractor to reimburse the Department for referee tests if more than three referee tests per project are required and the Engineer’s test results are closer to the referee test results than the Contractor’s test results.
- 4.9.2. **Production Acceptance.**
- 4.9.2.1. **Production Lot.** A production lot consists of four equal sublots. The default quantity for Lot 1 is 1,000 ton; however, when requested by the Contractor, the Engineer may increase the quantity for Lot 1 to no more than 2,000 ton. The Engineer will select subsequent lot sizes based on the anticipated daily production such that approximately three to four sublots are produced each day. The lot size will be between 1,000 ton and 4,000 ton. The Engineer may change the lot size before the Contractor begins any lot.
- 4.9.2.1.1. **Incomplete Production Lots.** If a lot is begun but cannot be completed, such as on the last day of production or in other circumstances deemed appropriate, the Engineer may close the lot. Close all lots within five working days unless otherwise allowed.
- 4.9.2.2. **Production Sampling.**
- 4.9.2.2.1. **Mixture Sampling.** Obtain hot-mix samples from trucks at the plant in accordance with [Tex-222-F](#). The sampler will split each sample into three equal portions in accordance with [Tex-200-F](#) and label these portions as “Contractor,” “Engineer,” and “Referee.” The Engineer will perform or witness the sample splitting and take immediate possession of the samples labeled “Engineer” and “Referee.” The Engineer will maintain the custody of the samples labeled “Engineer” and “Referee” until the Department’s testing is completed.

- 4.9.2.2.1.1. **Random Sample.** At the beginning of the project, the Engineer will select random numbers for all production sublots. Determine sample locations in accordance with [Tex-225-F](#). Take one sample for each subplot at the randomly selected location. The Engineer will perform or witness the sampling of production sublots.
- 4.9.2.2.1.2. **Blind Sample.** For one subplot per lot, the Engineer will obtain and test a “blind” sample instead of the random sample collected by the Contractor. Test either the “blind” or the random sample; however, referee testing (if applicable) will be based on a comparison of results from the “blind” sample. The location of the Engineer’s “blind” sample will not be disclosed to the Contractor. The Engineer’s “blind” sample may be randomly selected in accordance with [Tex-225-F](#) for any subplot or selected at the discretion of the Engineer. The Engineer will use the Contractor’s split sample for sublots not sampled by the Engineer.
- 4.9.2.2.2. **Informational Hamburg and Overlay Testing.** Select one random subplot from Lot 2 or higher for Hamburg and Overlay testing during the first week of production. Obtain and provide the Engineer with approximately 90 lb. of mixture, sampled in accordance with [Tex-222-F](#), in sealed containers, boxes, or bags labeled with the Control-Section-Job (CSJ), mixture type, lot, and subplot number. The Engineer will ship the mixture to the Materials and Tests Division for Hamburg and Overlay testing. Results from these tests will not be used for specification compliance.
- 4.9.2.2.3. **Asphalt Binder Sampling.** Obtain a 1-qt. (1 gal. for A-R binder) sample of the asphalt binder witness by the Engineer for each lot of mixture produced. The Contractor will notify the Engineer when the sampling will occur. Obtain the sample at approximately the same time the mixture random sample is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill and upstream from the introduction of any additives in accordance with [Tex-500-C](#), Part II. Label the can with the corresponding lot and subplot numbers, producer, producer facility, grade, district, date sampled, and project information including highway and CSJ. The Engineer will retain these samples for one year. The Engineer may also obtain independent samples. If obtaining an independent asphalt binder sample and upon request of the Contractor, the Engineer will split a sample of the asphalt binder with the Contractor.

At least once per project, the Engineer will collect split samples of each binder grade and source used. The Engineer will submit one split sample to the Materials and Tests Division to verify compliance with Item 300, “Asphalts, Oils, and Emulsions” and will retain the other split sample for 1 yr.

- 4.9.2.3. **Membrane Sampling.** The Engineer will obtain a 1-qt. sample of the polymer modified emulsion for each lot of mixture produced in accordance with [Tex-500-C](#), Part III. The Engineer will notify the Contractor when the sampling will occur and will witness the collection of the sample. Obtain the sample at approximately the same time the mixture random sample is obtained. Label the can with the corresponding lot and subplot numbers, producer, producer facility, grade, district, date sampled, and project information including highway and CSJ. The Engineer will retain these samples for two months.

At least once per project, the Engineer will collect split samples of the polymer modified emulsion. The Engineer will submit one split sample to the Materials and Tests Division to verify compliance with Item 300, “Asphalts, Oils, and Emulsions” and will retain the other split sample for two months. The Engineer may test as often as necessary to ensure the residual of the emulsion is greater than or equal to the specification requirement in Item 300, “Asphalts, Oils, and Emulsions.”

- 4.9.2. **Production Testing.** The Contractor and Engineer must perform production tests in accordance with Table 13. The Contractor has the option to verify the Engineer’s test results on split samples provided by the Engineer. Determine compliance with operational tolerances in accordance with Table 9 for all sublots.

At any time during production, the Engineer may require the Contractor to verify the following based on quantities used:

- lime content (within  $\pm 0.1\%$  of JMF), when PG binder is specified;
- fiber content (within  $\pm 0.03\%$  of JMF), when PG binder is specified; and
- CRM content (within  $\pm 1.5\%$  of JMF), when A-R binder is specified.

Maintain the in-line measuring device when A-R binder is specified to verify the A-R binder viscosity between

2,500 and 4,000 centipoise at 350°F unless otherwise approved. Record A-R binder viscosity at least once per hour and provide the Engineer with a daily summary unless otherwise directed.

If the aggregate mineralogy is such that [Tex-236-F](#) Part I does not yield reliable results, the Engineer may allow alternate methods for determining the asphalt content and aggregate gradation. The Engineer will require the Contractor to provide evidence that results from [Tex-236-F](#), Part I are not reliable before permitting an alternate method unless otherwise allowed. Use the applicable test procedure as directed if an alternate test method is allowed.

**Table 13**  
**Production and Placement Testing Frequency**

| Description  | Test Method                                     | Min Contractor Testing Frequency          | Min Engineer Testing Frequency |
|--|---|---|--------------------------------|
| Individual % retained for sieve sized larger than #200 | <a href="#">Tex-200-F</a>                       | 1 per subplot                             | 1 per 12 sublots               |
| % passing the #200 sieve                               |   |   |                                |
| Laboratory-molded density, %                           | <a href="#">Tex-207-E</a> , Part VIII           | 1 per subplot                             | 1 per lot                      |
| Asphalt binder content <sup>1</sup> , %                | <a href="#">Tex-236-F</a> , Part I <sup>2</sup> | 1 per subplot                             | 1 per lot                      |
| Drain-down, %  | <a href="#">Tex-235-F</a>                       | 1 per subplot                             | 1 per 12 sublots               |
| Boil test <sup>3</sup>                                 | <a href="#">Tex-530-C</a>                       | 1 per project                             | 1 per project                  |
| Membrane application rate                              | <a href="#">Tex-247-F</a>                       | 1 per lot                                 | 1 per 12 sublots               |
| Moisture content                                       | <a href="#">Tex-212-F</a> , Part II             | When directed                             | 1 per project                  |
| Cantabro loss, %                                       | <a href="#">Tex-245-F</a>                       | 1 per project (sample only)               | 1 per project                  |
| Overlay test   | <a href="#">Tex-248-F</a>                       | 1 per project (sample only) <sup>10</sup> | 1 per project <sup>4</sup>     |
| Hamburg Wheel test                                     | <a href="#">Tex-242-F</a>                       | 1 per project (sample only) <sup>10</sup> | 1 per project <sup>4</sup>     |
| Water flow test <sup>5</sup>                           | <a href="#">Tex-246-F</a>                       | 1 per subplot                             | 1 per project                  |
| Asphalt binder sampling                                | <a href="#">Tex-500-C</a> , Part II             | 1 per lot (sample only) <sup>6</sup>      | 1 per project                  |
| Membrane sampling and testing                          | <a href="#">Tex-500-C</a> , Part III            | N/A                                       | 1 per project                  |
| Thermal profile  | <a href="#">Tex-244-F</a>                       | 1 per subplot <sup>7,8,9</sup>            | 1 per project <sup>8</sup>     |

1. May be obtained from asphalt mass flow meter readouts as determined by the Engineer.
2. Ensure the binder content determination excludes fibers.
3. When shown on the plans.
4. When required according to mixture type and requirements in accordance with Table 8.
5. Only required for PFC mixtures.
6. Obtain samples witness by the Engineer. The Engineer will retain these samples for 1 yr.
7. To be performed in the presence of the Engineer when using the thermal camera, unless otherwise approved.
8. Not required when a thermal imaging system is used.
9. When using the thermal imaging system, the test report must include the temperature measurements taken in accordance with [Tex-244-F](#).
10. Testing performed by the Materials and Tests Division for informational purposes only.

#### 4.9.3.

**Operational Tolerances.** Control the production process within the operational tolerances in accordance with Table 9. Suspend production and placement operations when production or placement test results exceed the tolerances in accordance with Table 9 unless otherwise allowed. The Engineer will allow suspended production to resume when test results or other information indicates the next mixture produced will be within the operational tolerances.

- 4.9.4. **Individual Loads of Hot-Mix.** The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances in accordance with Table 9, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.
- 4.9.5. **Placement Acceptance.**
- 4.9.6. **Placement Lot.** A placement lot consists of four placement sublots. A placement subplot consists of the area placed during a production subplot.
- 4.9.7. **Miscellaneous Areas.** Miscellaneous areas include areas that typically involve significant handwork or discontinuous paving operations such as driveways, mailbox turnouts, crossovers, gores, spot level-up areas, and other similar areas. The specified layer thickness is based on the rate of 90 lb. per square yard for each inch of pavement unless another rate is shown on the plans. Miscellaneous areas are not subject to thermal profiles testing.
- 4.9.8. **Recovered Asphalt Dynamic Shear Rheometer (DSR).** The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Materials and Tests Division. The aging ratio is the DSR value of the extracted binder divided by the DSR value of the original unaged binder. Obtain DSR values in accordance with AASHTO T 315 at the specified high temperature performance grade of the asphalt. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores in accordance with [Tex-211-F](#).
- 4.9.9. **Irregularities.** Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. If the Engineer determines that the irregularity will adversely affect pavement performance, the Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities. The Engineer may also require the Contractor to remove and replace (at the Contractor's expense) areas where the mixture does not bond to the existing pavement.
- If irregularities are detected, the Engineer may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.
- 4.9.10. **Exempt Production.** When the anticipated daily production is less than 100 ton, all QC and QA sampling and testing are waived. The Engineer may deem the mixture as exempt production for the following conditions:
- anticipated daily production is more than 100 ton but less than 250 ton;
  - total production for the project is less than 2,500 ton;
  - when mutually agreed between the Engineer and the Contractor; or
  - when shown on the plans.
- For exempt production, the Contractor is relieved of all production and placement sampling and testing requirements. All other specification requirements apply, and the Engineer will perform acceptance tests for production and placement in accordance with Table 13.
- For exempt production:
- produce, haul, place, and compact the mixture as directed by the Engineer; and
  - control mixture production to yield a laboratory-molded density that is within  $\pm 1.0\%$  of the target density as tested by the Engineer.



- 4.9.11. **Ride Quality.** Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

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## 5. MEASUREMENT

- 5.1. **PFC Hot-Mix Asphalt.** Permeable friction course (PFC) hot-mix will be measured by the ton of composite mixture, which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."
- 5.2. **TBFC Hot-Mix Asphalt.** Thin bonded friction course (TBFC) hot-mix will be measured by the ton of composite mixture, which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."
- 5.3. **Membrane.** Membrane material will be measured by volume. Membrane material will be measured at the applied temperature by strapping the tank before and after road application and determining the net volume in gallons from the distributor's calibrated strap stick. The Engineer will witness all operations for volume determination. All membrane will be measured by the gallon applied, in the accepted membrane.

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## 6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under Section 3082.5.1., "PFC Hot-Mix Asphalt," will be paid for at the unit bid price for "Permeable friction course" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, removing pavement marking and markers, materials, placement, equipment, labor, tools, and incidentals.

The work performed and materials furnished in accordance with this Item and measured as provided under Section 3082.5.2., "TBFC Hot-Mix Asphalt," will be paid for at the unit bid price for "Thin bonded friction course" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, removing pavement marking and markers, materials, placement, equipment, labor, tools, and incidentals.

The work performed and materials furnished in accordance with this Item and measured as provided under Section 3082.5.3., "Membrane," will be paid for at the unit bid price for "Membrane" of the membrane material provided. These prices are full compensation for materials, placement, equipment, labor, tools, and incidentals.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."

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# Special Specification 3084

## Bonding Course

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### 1. DESCRIPTION

Construct a bonding course where improved bonding is needed using a Tracking-Resistant Asphalt Interlayer (TRAIL) or a Spray Applied Underseal Membrane, applied before the placement of a new hot-mix asphalt concrete pavement.

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### 2. MATERIALS

2.1. Furnish the materials for one of the following two options:

2.1.1. **TRAIL.** Furnish asphalt material described as “tack” for typical use in the TRAIL Material Producer List. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

2.1.2. **Spray Applied Underseal Membrane.** Furnish asphalt material meeting the requirements of Special Specification 3002, “Spray Applied Underseal Membrane.” Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

2.2. Furnish the material for applying tack coat to all miscellaneous contact surfaces when approved by the Engineer:

2.2.1. **Miscellaneous Tack.** Furnish TRAIL asphalt, CSS-1H, SS-1H, or a PG binder with a minimum high-temperature of PG 58 for tack coat binder in accordance with Item 300, “Asphalts, Oils, and Emulsions.” Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

2.3. **Sampling.** The Engineer will witness the collection of at least one sample of each asphalt binder per project in accordance with Tex-500-C, Part III, and test it to verify compliance with Item 300, “Asphalts, Oils, and Emulsions” or Special Specification 3002, “Spray Applied Underseal Membrane.”

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### 3. EQUIPMENT

3.1. **TRAIL.** Provide the equipment recommended by the producer.

3.2. **Spray Applied Underseal Membrane.** Provide in accordance with Special Specification 3002, “Spray Applied Underseal Membrane.”

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### 4. CONSTRUCTION

4.1. **Preparation.** Remove existing raised pavement markers. Repair any damage incurred by removal as directed. Remove dirt, dust, or other harmful material before sealing. When shown on the plans, remove vegetation and blade pavement edges. When approved by the Engineer, apply a thin, uniform coating of Miscellaneous Tack to all miscellaneous contact surfaces such as curbs, structures, and manholes. Prevent splattering of the tack coat when placed adjacent to curb, gutter, and structures.

4.2. **Test Strips.** When required by the Engineer, perform a test strip of TRAIL at a location on or near the project as directed. Allow the strip to cure for a maximum of 30 min. Drive over the test strip with equipment used during laid-down construction to simulate the effect of paving equipment. There should be no evidence of tracking or picking up of the TRAIL material on the wheels of the equipment.

- 4.3. **TRAIL.** Perform the following construction methods when applying a TRAIL for a bonding course:
- 4.3.1. **Placement.** Uniformly apply the TRAIL material to all areas where mix will be placed, including joints, at the rate shown on the plans or as directed, within 15°F of the approved temperature, and not above the maximum allowable temperature. Unless otherwise directed, uniformly apply the TRAIL material at a minimum rate specified on the plans. The Engineer may adjust the application rate, taking into consideration the existing pavement surface conditions.
- 4.4. **Spray Applied Underseal Membrane.** Place in accordance with Special Specification 3002, "Spray Applied Underseal Membrane."
- 4.4.1. **Placement.** Do not allow any loose mixture onto the prepared surface before application of the membrane. Unless otherwise directed, uniformly apply the membrane to all areas where mix will be placed, including joints, at the rate shown on the plans. Unless otherwise directed, uniformly apply the membrane at the minimum rate specified on the plans. The Engineer may adjust the application rate, taking into consideration the existing pavement surface conditions.
- 4.5. **Informational Shear Test.** Obtain one set of full depth core specimens per project in accordance with Tex-249-F within one working day of the time the lot placement is completed. The Engineer will select the core locations. Provide the cores to the Engineer in a container labeled with the Control-Section-Job (CSJ) and lot number. The district will determine the shear bond strength between the two bonded pavement layers in accordance with Tex-249-F. Results from these tests will not be used for specification compliance.
- 4.6. **Quality Control.** Stop application if it is not uniform due to streaking, ridging, pooling, or flowing off the roadway surface. Verify equipment condition, operating procedures, application temperature, and material properties. Determine and correct the cause of non-uniform application.

The Engineer may perform independent tests to confirm contractor compliance and may require testing differences or failing results to be resolved before resuming production.

The Engineer may stop the application and require construction of test strips at the Contractor's expense if any of the following occurs:

- Non-uniformity of application continues after corrective action;
- Evidence of tracking or picking up of the TRAIL;
- In 3 consecutive shots, application rate differs by more than 0.02 gal. per square yard from the rate directed; or
- Any shot differs by more than 0.04 gal. per square yard from the rate directed.

The Engineer will approve the test strip location. The Engineer may require additional test strips until surface treatment application meets specification requirements.

## 5. MEASUREMENT

- 5.1. **Volume.** The asphalt material, including all components, will be measured at the applied temperature by strapping the tank before and after road application and determining the net volume from the calibrated distributor. The Engineer will witness all strapping operations for volume determination. All asphalt material, including emulsions, will be measured by the gallon applied.

The Engineer may allow the use of a metering device to determine the asphalt volume used and application rate if the device is accurate to within 1.5% of the strapped volume.

## 6. 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 bid price for "Bonding Course." These prices are full compensation

for all materials, Miscellaneous Tack used for miscellaneous contact surfaces, equipment, labor, tools, and incidentals necessary to complete the work.

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# Special Specification 3096

## Asphalts, Oils, and Emulsions

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### 1. DESCRIPTION

Provide asphalt cements, cutback and emulsified asphalts, performance-graded asphalt binders, and other miscellaneous asphalt materials as specified on the plans.

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### 2. MATERIALS

Provide asphalt materials that meet the stated requirements when tested in conformance with the referenced Department, AASHTO, and ASTM test methods. Use asphalt containing recycled materials only if the recycled components meet the requirements of Article 6.9., "Recycled Materials." Provide asphalt materials that the Department has preapproved for use in accordance with [Tex-545-C](#), "Asphalt Binder Quality Program."

Inform the Department of all additives or modifiers included in the asphalt binder as part of the facility quality plan, as required by [Tex-545-C](#), "Asphalt Binder Quality Program," and provide that information to Department personnel. The Department reserves the right to prohibit the use of any asphalt additive or modifier.

Limit the use of polyphosphoric acid to no more than 0.5% by weight of the asphalt binder.

The use of re-refined engine oil bottoms is prohibited.

Acronyms used in this Item are defined in Table 1.

**Table 1**  
**Acronyms**

| Acronym                       | Definition  |
|-------------------------------|---|
| Test Procedure Designations   |   |
| Tex<br>T or R<br>D            | Department<br>AASHTO<br>ASTM  |
| Polymer Modifier Designations |   |
| P<br>SBR or L<br>SBS<br>TR    | polymer-modified<br>styrene-butadiene rubber (latex)<br>styrene-butadiene-styrene block co-polymer<br>tire rubber (from ambient temperature grinding of truck and<br>passenger tires) |
| AC                            | asphalt cement  |
| AE                            | asphalt emulsion  |
| AE-P                          | asphalt emulsion prime  |
| A-R                           | asphalt-rubber  |
| C                             | cationic  |
| EAP&T                         | emulsified asphalt prime and tack   |
| EBL                           | emulsified bonding layer  |
| FDR                           | full depth reclamation  |
| H-suffix                      | harder residue (lower penetration)  |
| HF                            | high float  |
| HY                            | high yield  |
| MC                            | medium-curing   |
| MS                            | medium-setting  |
| PCE                           | prime, cure, and erosion control  |
| PG                            | performance grade   |
| RC                            | rapid-curing  |
| RS                            | rapid-setting   |
| S-suffix                      | stockpile usage   |
| SCM                           | special cutback material  |
| SS                            | slow-setting  |
| SY                            | standard yield  |
| TRAIL                         | tracking resistant asphalt interlayer   |

2.1.

**Asphalt Cement.** Provide asphalt cement that is homogeneous, water-free, and nonfoaming when heated to 347°F, and meets the requirements in Table 2.

**Table 2**  
**Asphalt Cement**

| Property  | Test Procedure            | Viscosity Grade |     |        |     |      |     |      |       |       |       |
|---|---------------------------|-----------------|-----|--------|-----|------|-----|------|-------|-------|-------|
|   |                           | AC-0.6          |     | AC-1.5 |     | AC-3 |     | AC-5 |       | AC-10 |       |
|   |                           | Min             | Max | Min    | Max | Min  | Max | Min  | Max   | Min   | Max   |
| Viscosity<br>140°F, poise<br>275°F, poise   | T 202                     | 40              | 80  | 100    | 200 | 250  | 350 | 400  | 600   | 800   | 1,200 |
|   |                           | 0.4             | –   | 0.7    | –   | 1.1  | –   | 1.4  | –     | 1.9   | –     |
| Penetration, 77°F, 100g,<br>5 sec.  | T 49                      | 350             | –   | 250    | –   | 210  | –   | 135  | –     | 85    | –     |
| Flash point, C.O.C., °F   | T 48                      | 425             | –   | 425    | –   | 425  | –   | 425  | –     | 450   | –     |
| Solubility in<br>trichloroethylene, %   | T 44                      | 99.0            | –   | 99.0   | –   | 99.0 | –   | 99.0 | –     | 99.0  | –     |
| Spot test   | <a href="#">Tex-509-C</a> | Neg.            |     | Neg.   |     | Neg. |     | Neg. |       | Neg.  |       |
| Tests on residue from<br>RTFOT:<br>Viscosity, 140°F, poise<br>Ductility, <sup>1</sup> 77°F<br>5 cm/min., cm | T 240                     |                 |     |        |     |      |     |      |       |       |       |
|   | T 202                     | –               | 180 | –      | 450 | –    | 900 | –    | 1,500 | –     | 3,000 |
|   | T 51                      | 100             | –   | 100    | –   | 100  | –   | 100  | –     | 100   | –     |

1. If AC-0.6 or AC-1.5 ductility at 77°F is less than 100 cm, material is acceptable if ductility at 60°F is more than 100 cm.

- 2.2. **Polymer-Modified Asphalt Cement.** Provide polymer-modified asphalt cement that is smooth, homogeneous, and meets the requirements Table 3. Supply samples of the base asphalt cement and polymer additives if requested.

Table 3  
Polymer-Modified Asphalt Cement

| Property  | Test Procedure   | Polymer-Modified Viscosity Grade |     |                    |       |        |     |         |     |           |     |           |      |
|---|--|----------------------------------|-----|--------------------|-------|--------|-----|---------|-----|-----------|-----|-----------|------|
|   |  | AC-12-5TR                        |     | NT-HA <sup>1</sup> |       | AC-15P |     | AC-20XP |     | AC-10-2TR |     | AC-20-5TR |      |
|   |  | Min                              | Max | Min                | Max   | Min    | Max | Min     | Max | Min       | Max | Min       | Max  |
| Polymer   |  | TR                               |     | -                  |       | SBS    |     | SBS     |     | TR        |     | TR        |      |
| Polymer content, % (solids basis)                     | <a href="#">Tex-533-C</a> or <a href="#">Tex-553-C</a> | 5.0                              | -   | -                  | -     | 3.0    | -   | -       | -   | 2.0       | -   | 5.0       | -    |
| Dynamic shear, G*/sinδ, 82°C, 10 rad/s, kPa           | T 315  |                                  |     | 1.0                | -     |        |     |         |     |           |     |           |      |
| Dynamic shear, G*/sinδ, 64°C, 10 rad/s, kPa           | T 315  | -                                | -   | -                  | -     | -      | -   | 1.0     | -   | -         | -   | 1.0       | -    |
| Dynamic shear, G*/sinδ, 58°C, 10 rad/s, kPa           | T 315  | 1.0                              | -   | -                  | -     | -      | -   | -       | -   | 1.0       | -   | -         | -    |
| Viscosity<br>140°F, poise                             | T 202  | 1,200                            | -   |                    |       | 1,500  | -   | 2,000   | -   | 1,000     | -   | 2,000     | -    |
| 275°F, poise  | T 202  |                                  |     | -                  | 4,000 | -      | 8.0 | -       | -   | -         | 8.0 | -         | 10.0 |
| Penetration, 77°F, 100 g, 5 sec.                      | T 49   | 110                              | 150 | -                  | 25    | 100    | 150 | 75      | 115 | 95        | 130 | 75        | 115  |
| Ductility, 5cm/min., 39.2°F, cm                       | T 51   |                                  |     |                    |       | -      | -   | -       | -   | -         | -   | -         | -    |
| Elastic recovery, 50°F, %                             | <a href="#">Tex-539-C</a>                              | 55                               | -   |                    |       | 55     | -   | 55      | -   | 30        | -   | 55        | -    |
| Softening point, °F                                   | T 53   | 113                              | -   | 170                | -     | -      | -   | 120     | -   | 110       | -   | 120       | -    |
| Polymer separation, 5 hr.                             | <a href="#">Tex-540-C</a>                              | None                             |     |                    |       | None   |     | None    |     | None      |     | None      |      |
| Flash point, C.O.C., °F                               | T 48   | 425                              | -   | 425                | -     | 425    | -   | 425     | -   | 425       | -   | 425       | -    |
| Tests on residue from RTFOT aging and pressure aging: | T 240 and R 28   |                                  |     |                    |       |        |     |         |     |           |     |           |      |
| Creep stiffness S, -18°C, MPa                         | T 313  | -                                | 300 | -                  | -     | -      | 300 | -       | 300 | -         | 300 | -         | 300  |
| m-value, -18°C  |  | 0.300                            | -   | -                  | -     | 0.300  | -   | 0.300   | -   | 0.300     | -   | 0.300     | -    |

1. Non-Tracking Hot Applied Tack Coat - TRAIL product

- 2.3. **Cutback Asphalt.** Provide cutback asphalt that meets the requirements of Tables 4, 5, and 6, for the specified type and grade. Supply samples of the base asphalt cement and polymer additives if requested.

**Table 4**  
**Rapid-Curing Cutback Asphalt**

| Property  | Test Procedure            | Type-Grade |       |        |       |         |       |
|---|---------------------------|------------|-------|--------|-------|---------|-------|
|   |                           | RC-250     |       | RC-800 |       | RC-3000 |       |
|   |                           | Min        | Max   | Min    | Max   | Min     | Max   |
| Kinematic viscosity, 140°F, cSt                               | T 201                     | 250        | 400   | 800    | 1,600 | 3,000   | 6,000 |
| Water, %  | D95                       | –          | 0.2   | –      | 0.2   | –       | 0.2   |
| Flash point, T.O.C., °F                                       | T 79                      | 80         | –     | 80     | –     | 80      | –     |
| Distillation test:  | T 78                      |            |       |        |       |         |       |
| Distillate, percentage by volume of total distillate to 680°F |                           |            |       |        |       |         |       |
| to 437°F  |                           | 40         | 75    | 35     | 70    | 20      | 55    |
| to 500°F  |                           | 65         | 90    | 55     | 85    | 45      | 75    |
| to 600°F  |                           | 85         | –     | 80     | –     | 70      | –     |
| Residue from distillation, volume %                           |                           | 70         | –     | 75     | –     | 82      | –     |
| Tests on distillation residue:                                |                           |            |       |        |       |         |       |
| Viscosity, 140°F, poise                                       | T 202                     | 600        | 2,400 | 600    | 2,400 | 600     | 2,400 |
| Ductility, 5 cm/min., 77°F, cm                                | T 51                      | 100        | –     | 100    | –     | 100     | –     |
| Solubility in trichloroethylene, %                            | T 44                      | 99.0       | –     | 99.0   | –     | 99.0    | –     |
| Spot test   | <a href="#">Tex-509-C</a> | Neg.       |       | Neg.   |       | Neg.    |       |

**Table 5**  
**Medium-Curing Cutback Asphalt**

| Property  | Test Procedure            | Type-Grade |       |        |       |        |       |         |       |
|---|---------------------------|------------|-------|--------|-------|--------|-------|---------|-------|
|   |                           | MC-30      |       | MC-250 |       | MC-800 |       | MC-3000 |       |
|   |                           | Min        | Max   | Min    | Max   | Min    | Max   | Min     | Max   |
| Kinematic viscosity, 140°F, cSt                               | T 201                     | 30         | 60    | 250    | 500   | 800    | 1,600 | 3,000   | 6,000 |
| Water, %  | D95                       | –          | 0.2   | –      | 0.2   | –      | 0.2   | –       | 0.2   |
| Flash point, T.O.C., °F                                       | T 79                      | 95         | –     | 122    | –     | 140    | –     | 149     | –     |
| Distillation test:  | T 78                      |            |       |        |       |        |       |         |       |
| Distillate, percentage by volume of total distillate to 680°F |                           |            |       |        |       |        |       |         |       |
| to 437°F  |                           | –          | 35    | –      | 20    | –      | –     | –       | –     |
| to 500°F  |                           | 30         | 75    | 5      | 55    | –      | 40    | –       | 15    |
| to 600°F  |                           | 75         | 95    | 60     | 90    | 45     | 85    | 15      | 75    |
| Residue from distillation, volume %                           |                           | 50         | –     | 67     | –     | 75     | –     | 80      | –     |
| Tests on distillation residue:                                |                           |            |       |        |       |        |       |         |       |
| Viscosity, 140°F, poise                                       | T 202                     | 300        | 1,200 | 300    | 1,200 | 300    | 1,200 | 300     | 1,200 |
| Ductility, 5 cm/min., 77°F, cm                                | T 51                      | 100        | –     | 100    | –     | 100    | –     | 100     | –     |
| Solubility in trichloroethylene, %                            | T 44                      | 99.0       | –     | 99.0   | –     | 99.0   | –     | 99.0    | –     |
| Spot test   | <a href="#">Tex-509-C</a> | Neg.       |       | Neg.   |       | Neg.   |       | Neg.    |       |



**Table 6**  
**Special-Use Cutback Asphalt**

| Property  | Test Procedure            | Type-Grade |       |       |       |        |       |
|---|---------------------------|------------|-------|-------|-------|--------|-------|
|   |                           | MC-2400L   |       | SCM I |       | SCM II |       |
|   |                           | Min        | Max   | Min   | Max   | Min    | Max   |
| Kinematic viscosity, 140°F, cSt                               | T 201                     | 2,400      | 4,800 | 500   | 1,000 | 1,000  | 2,000 |
| Water, %  | D95                       | –          | 0.2   | –     | 0.2   | –      | 0.2   |
| Flash point, T.O.C., °F                                       | T 79                      | 150        | –     | 175   | –     | 175    | –     |
| Distillation test:  | T 78                      |            |       |       |       |        |       |
| Distillate, percentage by volume of total distillate to 680°F |                           |            |       |       |       |        |       |
| to 437°F  |                           | –          | –     | –     | –     | –      | –     |
| to 500°F  |                           | –          | 35    | –     | 0.5   | –      | 0.5   |
| to 600°F  |                           | 35         | 80    | 20    | 60    | 15     | 50    |
| Residue from distillation, volume %                           |                           | 78         | –     | 76    | –     | 82     | –     |
| Tests on distillation residue:                                |                           |            |       |       |       |        |       |
| Polymer   |                           | SBR        |       | –     |       | –      |       |
| Polymer content, % (solids basis)                             | <a href="#">Tex-533-C</a> | 2.0        | –     | –     | –     | –      | –     |
| Penetration, 100 g, 5 sec., 77°F                              | T 49                      | 150        | 300   | 180   | –     | 180    | –     |
| Ductility, 5 cm/min., 39.2°F, cm                              | T 51                      | 50         | –     | –     | –     | –      | –     |
| Solubility in trichloroethylene, %                            | T 44                      | 99.0       | –     | 99.0  | –     | 99.0   | –     |

- 2.4. **Emulsified Asphalt.** Provide emulsified asphalt that is homogeneous, does not separate after thorough mixing, and meets the requirements for the specified type and grade in Tables 7, 8, 9, 10, and 10A-C.

**Table 7**  
**Emulsified Asphalt**

| Property   | Test Procedure               | Type-Grade                  |                    |                         |                    |                           |                  |                         |                    |                       |                    |
|--|------------------------------|-----------------------------|--------------------|-------------------------|--------------------|---------------------------|------------------|-------------------------|--------------------|-----------------------|--------------------|
|  |                              | Rapid-Setting               |                    | Medium-Setting          |                    |                           |                  | Slow-Setting            |                    |                       |                    |
|  |                              | HFRS-2                      |                    | MS-2                    |                    | AES-300                   |                  | SS-1                    |                    | SS-1H                 |                    |
|  |                              | Min                         | Max                | Min                     | Max                | Min                       | Max              | Min                     | Max                | Min                   | Max                |
| Viscosity, Saybolt Furol<br>77°F, sec.<br>122°F, sec.  | T 72                         | -                           | -                  | -                       | -                  | 75                        | 400              | 20                      | 100                | 20                    | 100                |
| Sieve test, %  | T 59                         | -                           | 0.1                | -                       | 0.1                | -                         | 0.1              | -                       | 0.1                | -                     | 0.1                |
| Miscibility  | T 59                         | -                           |                    | -                       |                    | -                         |                  | Pass                    |                    | Pass                  |                    |
| Cement mixing, %   | T 59                         | -                           | -                  | -                       | -                  | -                         | -                | -                       | 2.0                | -                     | 2.0                |
| Coating ability and water resistance:<br>Dry aggregate/after spray<br>Wet aggregate/after spray  | T 59                         | -                           |                    | -                       |                    | Good/Fair<br>Fair/Fair    |                  | -                       |                    | -                     |                    |
| Demulsibility, 35 mL of 0.02 N CaCl <sub>2</sub> , %   | T 59                         | 50                          | -                  | -                       | 30                 | -                         | -                | -                       | -                  | -                     | -                  |
| Storage stability, 1 day, %  | T 59                         | -                           | 1                  | -                       | 1                  | -                         | 1                | -                       | 1                  | -                     | 1                  |
| Freezing test, 3 cycles <sup>1</sup>   | T 59                         | -                           |                    | Pass                    |                    | -                         |                  | Pass                    |                    | Pass                  |                    |
| Distillation test:<br>Residue by distillation, % by wt.<br>Oil distillate, % by volume of emulsion   | T 59                         | 65                          | -                  | 65                      | -                  | 65                        | -                | 60                      | -                  | 60                    | -                  |
|  |                              | -                           | 0.5                | -                       | 0.5                | -                         | 5                | -                       | 0.5                | -                     | 0.5                |
| Tests on residue from distillation:<br>Penetration, 77°F, 100 g, 5 sec.<br>Solubility in trichloroethylene, %<br>Ductility, 77°F, 5 cm/min., cm<br>Float test, 140°F, sec. | T 49<br>T 44<br>T 51<br>T 50 | 100<br>97.5<br>100<br>1,200 | 140<br>-<br>-<br>- | 120<br>97.5<br>100<br>- | 160<br>-<br>-<br>- | 300<br>97.5<br>-<br>1,200 | -<br>-<br>-<br>- | 120<br>97.5<br>100<br>- | 160<br>-<br>-<br>- | 70<br>97.5<br>80<br>- | 100<br>-<br>-<br>- |

1. Applies only when the Engineer designates material for winter use.

**Table 8**  
**Cationic Emulsified Asphalt**

| Property  | Test Procedure       | Type-Grade         |               |                  |               |                        |               |                        |             |                    |               |                  |               |
|---|----------------------|--------------------|---------------|------------------|---------------|------------------------|---------------|------------------------|-------------|--------------------|---------------|------------------|---------------|
|   |                      | Rapid-Setting      |               | Medium-Setting   |               |                        |               | Slow-Setting           |             |                    |               |                  |               |
|   |                      | CRS-2              |               | CRS-2H           |               | CMS-2                  |               | CMS-2S                 |             | CSS-1              |               | CSS-1H           |               |
|   |                      | Min                | Max           | Min              | Max           | Min                    | Max           | Min                    | Max         | Min                | Max           | Min              | Max           |
| Viscosity, Saybolt Furol<br>77°F, sec.<br>122°F, sec.   | T 72                 | -                  | -             | -                | -             | -                      | -             | -                      | -           | 20                 | 100           | 20               | 100           |
| Sieve test, %   | T 59                 | -                  | 0.1           | -                | 0.1           | -                      | 0.1           | -                      | 0.1         | -                  | 0.1           | -                | 0.1           |
| Cement mixing, %  | T 59                 | -                  | -             | -                | -             | -                      | -             | -                      | -           | -                  | 2.0           | -                | 2.0           |
| Coating ability and water resistance:<br>Dry aggregate/after spray<br>Wet aggregate/after spray   | T 59                 | -                  |               | -                |               | Good/Fair<br>Fair/Fair |               | Good/Fair<br>Fair/Fair |             | -                  |               | -                |               |
| Demulsibility, 35 mL of 0.8% Sodium dioctyl sulfosuccinate, %   | T 59                 | 70                 | -             | 70               | -             | -                      | -             | -                      | -           | -                  | -             | -                | -             |
| Storage stability, 1 day, %   | T 59                 | -                  | 1             | -                | 1             | -                      | 1             | -                      | 1           | -                  | 1             | -                | 1             |
| Particle charge   | T 59                 | Positive           |               | Positive         |               | Positive               |               | Positive               |             | Positive           |               | Positive         |               |
| Distillation test:<br>Residue by distillation, % by wt.<br>Oil distillate, % by volume of emulsion  | T 59                 | 65                 | -             | 65               | -             | 65                     | -             | 65                     | -           | 60                 | -             | 60               | -             |
|   |                      | -                  | 0.5           | -                | 0.5           | -                      | 7             | -                      | 5           | -                  | 0.5           | -                | 0.5           |
| Tests on residue from distillation:<br>Penetration, 77°F, 100 g, 5 sec.<br>Solubility in trichloroethylene, %<br>Ductility, 77°F, 5 cm/min., cm | T 49<br>T 44<br>T 51 | 120<br>97.5<br>100 | 160<br>-<br>- | 70<br>97.5<br>80 | 110<br>-<br>- | 120<br>97.5<br>100     | 200<br>-<br>- | 300<br>97.5<br>-       | -<br>-<br>- | 120<br>97.5<br>100 | 160<br>-<br>- | 70<br>97.5<br>80 | 110<br>-<br>- |

**Table 9**  
**Polymer-Modified Emulsified Asphalt**

| Property  | Test Procedure                     | Type-Grade    |     |                        |     |                        |     |                        |     |       |     |
|---|------------------------------------|---------------|-----|------------------------|-----|------------------------|-----|------------------------|-----|-------|-----|
|   |                                    | Rapid-Setting |     | Medium-Setting         |     |                        |     | Slow-Setting           |     |       |     |
|   |                                    | HFRS-2P       |     | AES-150P               |     | AES-300P               |     | AES-300S               |     | SS-1P |     |
|   |                                    | Min           | Max | Min                    | Max | Min                    | Max | Min                    | Max | Min   | Max |
| Viscosity, Saybolt Furol<br>77°F, sec.<br>122°F, sec.   | T 72                               | -             | -   | 75                     | 400 | 75                     | 400 | 75                     | 400 | 30    | 100 |
| Sieve test, %   | T 59                               | -             | 0.1 | -                      | 0.1 | -                      | 0.1 | -                      | 0.1 | -     | 0.1 |
| Miscibility   | T 59                               | -             |     | -                      |     | -                      |     | -                      |     | Pass  |     |
| Coating ability and water resistance:<br>Dry aggregate/after spray<br>Wet aggregate/after spray                 | T 59                               | -             |     | Good/Fair<br>Fair/Fair |     | Good/Fair<br>Fair/Fair |     | Good/Fair<br>Fair/Fair |     | -     |     |
| Demulsibility, 35 mL of 0.02 N CaCl <sub>2</sub> , %  | T 59                               | 50            | -   | -                      | -   | -                      | -   | -                      | -   | -     | -   |
| Storage stability, 1 day, %   | T 59                               | -             | 1   | -                      | 1   | -                      | 1   | -                      | 1   | -     | 1   |
| Breaking index, g   | <a href="#">Tex-542-C</a>          | -             | -   |                        |     |                        |     |                        |     |       |     |
| Distillation test: <sup>1</sup><br>Residue by distillation, % by wt.<br>Oil distillate, % by volume of emulsion | T 59                               | 65            | -   | 65                     | -   | 65                     | -   | 65                     | -   | 60    | -   |
|   |                                    | -             | 0.5 | -                      | 3   | -                      | 5   | -                      | 7   | -     | 0.5 |
| Tests on residue from distillation:<br>Polymer content, wt. % (solids basis)                                    | <a href="#">Tex-533-C</a>          | 3.0           | -   | -                      | -   | -                      | -   | -                      | -   | 3.0   | -   |
| Penetration, 77°F, 100 g, 5 sec.  | T 49                               | 90            | 140 | 150                    | 300 | 300                    | -   | 300                    | -   | 100   | 140 |
| Solubility in trichloroethylene, %  | T 44                               | 97.0          | -   | 97.0                   | -   | 97.0                   | -   | 97.0                   | -   | 97.0  | -   |
| Viscosity, 140°F, poise   | T 202                              | 1,500         | -   | -                      | -   | -                      | -   | -                      | -   | 1,300 | -   |
| Float test, 140°F, sec  | T 50                               | 1,200         | -   | 1,200                  | -   | 1,200                  | -   | 1,200                  | -   | -     | -   |
| Ductility, <sup>2</sup> 39.2°F, 5 cm/min., cm   | T 51                               | 50            | -   | -                      | -   | -                      | -   | -                      | -   | 50    | -   |
| Elastic recovery, 250°F, %  | <a href="#">Tex-539-C</a>          | 55            | -   | -                      | -   | -                      | -   | -                      | -   | -     | -   |
| Tests on RTFO curing of distillation residue<br>Elastic recovery, 50°F, %                                       | T 240<br><a href="#">Tex-536-C</a> | -             | -   | 50                     | -   | 50                     | -   | 30                     | -   | -     | -   |

1. Exception to T 59: Bring the temperature on the lower thermometer slowly to 350°F ±10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 min. (±5 min.) from the first application of heat.

2. HFRS-2P must meet one of either the ductility or elastic recovery requirements.

**Table 10**  
**Polymer-Modified Cationic Emulsified Asphalt**

| Property   | Test Procedure     | Type-Grade    |     |          |     |                  |     |                     |                 |                     |                 |              |     |
|--|--------------------|---------------|-----|----------|-----|------------------|-----|---------------------|-----------------|---------------------|-----------------|--------------|-----|
|  |                    | Rapid-Setting |     |          |     |                  |     | Medium-Setting      |                 |                     |                 | Slow-Setting |     |
|  |                    | CRS-2P        |     | CHFRS-2P |     | CRS-2TR          |     | CMS-1P <sup>3</sup> |                 | CMS-2P <sup>3</sup> |                 | CSS 1P       |     |
|  |                    | Min           | Max | Min      | Max | Min              | Max | Min                 | Max             | Min                 | Max             | Min          | Max |
| Viscosity, Saybolt Furol<br>77°F, sec.<br>122°F, sec.                        | T 72               | -             | -   | -        | -   | -                | -   | 10                  | 100             | -                   | -               | 20           | 100 |
|  |                    | 150           | 400 | 100      | 400 | 150              | 500 | -                   | -               | 50                  | 400             | -            | -   |
| Sieve test, %  | T 59               | -             | 0.1 | -        | 0.1 | -                | 0.1 | -                   | 0.1             | -                   | 0.1             | -            | 0.1 |
| Demulsibility, 35 ml of 0.8% sodium dioctyl sulfosuccinate, %                | T 59               | 70            | -   | 60       | -   | 40               | -   | -                   | -               | -                   | -               | -            | -   |
| Storage stability, 1 day, %  | T 59               | -             | 1   | -        | 1   | -                | 1   | -                   | 1               | -                   | 1               | -            | 1   |
| Breaking index, g  | Tex-542-C          | -             | -   | -        | -   | -                | -   | -                   | -               | -                   | -               | -            | -   |
| Particle charge  | T 59               | Positive      |     | Positive |     | Positive         |     | Positive            |                 | Positive            |                 | Positive     |     |
| Distillation test <sup>1</sup> :   | T 59               |               |     |          |     |                  |     |                     |                 |                     |                 |              |     |
| Residue by distillation, % by weight   |                    | 65            | -   | 65       | -   | 65               | -   | 30                  | -               | 60                  | -               | 62           | -   |
| Oil distillate, % by volume of emulsion                                      |                    | -             | 0.5 | -        | 0.5 | -                | 3   | -                   | 0.5             | -                   | 0.5             | -            | 0.5 |
| Tests on residue from distillation:  |                    |               |     |          |     |                  |     |                     |                 |                     |                 |              |     |
| Polymer content, wt. % (solids basis)  | Tex-533-C          | 3.0           | -   | 3.0      | -   | 5.0 <sup>7</sup> | -   | -                   | -               | -                   | -               | 3.0          | -   |
| Penetration, 77°F, 100 g, 5 sec.   | T 49               | 90            | 150 | 80       | 130 | 90               | 150 | 30                  | -               | 30                  | -               | 55           | 90  |
| Viscosity, 140°F, poise  | T 202              | 1,300         | -   | 1,300    | -   | 1,000            | -   | -                   | -               | -                   | -               | -            | -   |
| Solubility in trichloroethylene, %   | T 44               | 97.0          | -   | 95.0     | -   | 98               | -   | -                   | -               | -                   | -               | 97.0         | -   |
| Softening point, °F  | T 53               | -             | -   | -        | -   | -                | -   | -                   | -               | -                   | -               | 135          | -   |
| Ductility, 77°F, 5 cm/min., cm   | T 51               | -             | -   | -        | -   | 40               | -   | -                   | -               | -                   | -               | 70           | -   |
| Float test, 140°F, sec.  | T 50               | -             | -   | 1,800    | -   | -                | -   | -                   | -               | -                   | -               | -            | -   |
| Ductility, <sup>2</sup> 39.2°F, 5 cm/min., cm                                | T 51               | 50            | -   | -        | -   | -                | -   | -                   | -               | -                   | -               | -            | -   |
| Elastic recovery, <sup>2</sup> 50°F, %                                       | Tex-539-C          | 55            | -   | 55       | -   | -                | -   | -                   | -               | -                   | -               | -            | -   |
| Tests on residue from evaporative recovery:                                  | R 78, Procedure B  |               |     |          |     |                  |     |                     |                 |                     |                 |              |     |
| Nonrecoverable creep compliance of residue, 3.2 kPa, 52°C, kPa <sup>-1</sup> | T 350              | -             | -   | -        | -   | -                | -   | -                   | 2.0             | -                   | 4.0             | -            | -   |
| Tests on rejuvenating agent:   |                    |               |     |          |     |                  |     |                     |                 |                     |                 |              |     |
| Viscosity, 140°F, cSt  | T 201              | -             | -   | -        | -   | -                | -   | 50                  | 175             | 50                  | 175             | -            | -   |
| Flash point, C.O.C., °F  | T 48               | -             | -   | -        | -   | -                | -   | 380                 | -               | 380                 | -               | -            | -   |
| Saturates, % by weight   | D 2007             | -             | -   | -        | -   | -                | -   | -                   | 30              | -                   | 30              | -            | -   |
| Solubility in n-pentane, % by weight   | D 2007             | -             | -   | -        | -   | -                | -   | 99                  | -               | 99                  | -               | -            | -   |
| Tests on rejuvenating agent after RTFO                                       | T 240              |               |     |          |     |                  |     |                     |                 |                     |                 |              |     |
| Weight Change, %   |                    | -             | -   | -        | -   | -                | -   | -                   | 6.5             | -                   | 6.5             | -            | -   |
| Viscosity Ratio  |                    | -             | -   | -        | -   | -                | -   | -                   | 3.0             | -                   | 3.0             | -            | -   |
| Tests on latex <sup>4</sup> :  |                    |               |     |          |     |                  |     |                     |                 |                     |                 |              |     |
| Tensile strength, die C dumbbell, psi  | D 412 <sup>5</sup> | -             | -   | -        | -   | -                | -   | 800                 | -               | 800                 | -               | -            | -   |
| Change in mass after immersion in rejuvenating agent, %                      | D 471              | -             | -   | -        | -   | -                | -   | -                   | 40 <sup>6</sup> | -                   | 40 <sup>6</sup> | -            | -   |

- Exception to T 59: Bring the temperature on the lower thermometer slowly to 350°F (±0°F). Maintain at this temperature for 20 min. Complete total distillation in 60 min. (±5 min.) from the first application of heat.
- CRS-2P must meet one of either the ductility or elastic recovery requirements.
- With all precertification samples of CMS-1P or CMS-2P, submit certified test reports showing that the rejuvenating agent and latex meet the stated requirements. Submit samples of these raw materials if requested by the Engineer.
- Preparation of latex specimens: use any substrate and recovery method which produces specimens of uniform dimensions and which delivers enough material to achieve desired residual thickness.
- Cut samples for tensile strength determination using a crosshead speed of 20 in. per minute.
- Specimen must remain intact after exposure and removal of excess rejuvenating agent.
- Modifier type is tire rubber.

**Table 10A**  
**Non-Tracking Tack Coat Emulsion<sup>1</sup>**

| Property  | Test Procedure                | NT-HRE                  |                   | NT-RRE               |                   | NT-SRE               |                   |
|---|-------------------------------|-------------------------|-------------------|----------------------|-------------------|----------------------|-------------------|
|   |                               | Min                     | Max               | Min                  | Max               | Min                  | Max               |
| Viscosity, Saybolt Furol<br>77° F, sec.   | T 72                          | 15                      | –                 | 15                   | –                 | 10                   | 100               |
| Storage stability, 1 Day, %   | T 59                          | –                       | 1                 | –                    | 1                 | –                    | 1                 |
| Settlement, 5-day, %  | T 59                          | –                       | 5                 | –                    | 5                 | –                    | 5                 |
| Sieve test, %   | T 59                          | –                       | 0.30              | –                    | 0.30              | –                    | 0.1               |
| Distillation test: <sup>2</sup><br>Residue by distillation, % by wt.<br>Oil distillate, by volume of emulsion   | T 59                          | 50                      | –                 | 58                   | –                 | 50                   | –                 |
| Test on residue from distillation:<br>Penetration, 77°F, 100 g, 5 sec.<br>Solubility in trichloroethylene, %<br>Softening point, °F<br>Dynamic shear, G*/sin(δ), 82°C, 10<br>rad/s, kPa | T 49<br>T 44<br>T 53<br>T 315 | –<br>97.5<br>150<br>1.0 | 20<br>–<br>–<br>– | 15<br>97.5<br>–<br>– | 45<br>–<br>–<br>– | 40<br>97.5<br>–<br>– | 90<br>–<br>–<br>– |

1. Due to the hardness of the residue, these emulsions should be heated to 120-140°F before thoroughly mixing as the emulsion is being prepared for testing.
2. Exception to T 59: Bring the temperature on the lower thermometer slowly to 350°F ± 10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 ± 5 min. from first application of heat.

**Table 10B**  
**Spray Applied Underseal Membrane Polymer-Modified Emulsions (EBL)**

| Property  | Test Procedure                    | Min      | Max      |
|---|-----------------------------------|----------|----------|
| Viscosity @ 77°F, SSF   | T 72                              | 20       | 100      |
| Storage Stability <sup>1</sup> , %  | T 59                              | –        | 1        |
| Demulsibility <sup>2</sup><br>Anionic emulsions – 35 mL of 0.02 N CaCl <sub>2</sub> , %<br>Cationic emulsions – 35 mL of 0.8% sodium<br>dioctyl sulfosuccinate, % | T 59                              | 55       | –        |
| Sieve Test <sup>3</sup> , %   | T 59                              | –        | 0.05     |
| Distillation Test <sup>4</sup><br>Residue by distillation, % by wt.<br>Oil portion of distillate, % by vol.   | T 59                              | 63       | 0.5      |
| Test on Residue from Distillation<br>Elastic Recovery @ 50°F, 50 mm/min., %<br>Penetration @ 77°F, 100 g, 5 sec., 0.1 mm  | <a href="#">Tex-539-C</a><br>T 49 | 60<br>80 | –<br>130 |

1. After standing undisturbed for 24 hr., the surface must be smooth, must not exhibit a white or milky colored substance, and must be a homogeneous color throughout.
2. Material must meet demulsibility test for emulsions.
3. May be required by the Engineer only when the emulsion cannot be easily applied in the field.
4. The temperature on the lower thermometer should be brought slowly to 350°F ± 10°F and maintained at this temperature for 20 min. The total distillation should be completed in 60 ± 5 min. from the first application of heat.

**Table 10C**  
**Full-Depth Reclamation Emulsion (FDR EM)**

| Property   | Test Procedure                | Standard Yield (SY) |                  | High Yield (HY)      |                    |
|--|-------------------------------|---------------------|------------------|----------------------|--------------------|
|  |                               | Min                 | Max              | Min                  | Max                |
| Sieve test, %  | T 59                          | –                   | 0.1              | –                    | 0.1                |
| Viscosity Saybolt Furol @ 77°F, sec.   | T 59                          | 20                  | 100              | 20                   | 100                |
| Distillation test <sup>1</sup> :<br>Residue by distillation, % by wt.<br>Oil portion of distillate, % by vol.                              | T 59                          | 60                  | –                | 63                   | –                  |
| Test on residue from distillation:<br>Penetration @ 77°F, dmm  | T 49                          | 55                  | 95               | 120                  | –                  |
| Test on rejuvenating agent:<br>BWOA, % <sup>2</sup><br>Viscosity @ 140°F, cSt<br>Flash Point, COC, °F<br>Solubility in n-pentane, % by wt. | ***<br>T 201<br>T 48<br>D2007 | –<br>–<br>–<br>–    | –<br>–<br>–<br>– | 2<br>50<br>380<br>99 | –<br>175<br>–<br>– |

1. The temperature on the lower thermometer should be brought slowly to 350°F ± 10°F and maintained at this temperature for 20 min. The total distillation should be completed in 60 ± 5 min. from the first application of heat.
2. BWOA = By weight of asphalt. Provide a manufacturer's certificate of analysis (COA) with the percent of rejuvenator added.

2.5.

**Specialty Emulsions.** Provide specialty emulsion that is either asphalt-based or resin-based and meets the requirements of Table 11 or Table 11A.

**Table 11**  
**Specialty Emulsions**

| Property  | Test Procedure                        | Type-Grade     |     |       |     |                  |     |
|---|---------------------------------------|----------------|-----|-------|-----|------------------|-----|
|   |                                       | Medium-Setting |     |       |     | Slow-Setting     |     |
|   |                                       | AE-P           |     | EAP&T |     | PCE <sup>1</sup> |     |
|   |                                       | Min            | Max | Min   | Max | Min              | Max |
| Viscosity, Saybolt Furol<br>77°F, sec.<br>122°F, sec.   | T 72                                  | –              | –   | –     | –   | 10               | 100 |
| Sieve test, %   | T 59                                  | –              | 0.1 | –     | 0.1 | –                | 0.1 |
| Miscibility <sup>2</sup>  | T 59                                  | –              | –   | Pass  | –   | Pass             | –   |
| Demulsibility, 35 mL of 0.10 N CaCl <sub>2</sub> , %  | T 59                                  | –              | 70  | –     | –   | –                | –   |
| Storage stability, 1 day, %   | T 59                                  | –              | 1   | –     | 1   | –                | –   |
| Particle size, <sup>5</sup> % by volume < 2.5 μm  | <a href="#">Tex-238-F<sup>3</sup></a> | –              | –   | 90    | –   | 90               | –   |
| Asphalt emulsion distillation to 500°F followed by Cutback asphalt distillation of residue to 680°F:<br>Residue after both distillations, % by wt.<br>Total oil distillate from both distillations, % by volume of emulsion | T 59 & T 78                           | 40             | –   | –     | –   | –                | –   |
|   |                                       | 25             | 40  | –     | –   | –                | –   |
| Residue by distillation, % by wt.   | T 59                                  | –              | –   | 60    | –   | –                | –   |
| Residue by evaporation, <sup>4</sup> % by wt.   | T 59                                  | –              | –   | –     | –   | 60               | –   |
| Tests on residue after all distillations:   |                                       |                |     |       |     |                  |     |
| Viscosity, 140°F, poise   | T 202                                 | –              | –   | 800   | –   | –                | –   |
| Kinematic viscosity, <sup>5</sup> 140°F, cSt  | T 201                                 | –              | –   | –     | –   | 100              | 350 |
| Flash point C.O.C., °F  | T 48                                  | –              | –   | –     | –   | 400              | –   |
| Solubility in trichloroethylene, %  | T 44                                  | 97.5           | –   | –     | –   | –                | –   |
| Float test, 122°F, sec.   | T 50                                  | 50             | 200 | –     | –   | –                | –   |

1. Supply with each shipment of PCE:

- a copy of a lab report from an approved analytical lab, signed by a lab official, indicating the PCE formulation does not meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste;
  - a certification from the producer that the formulation supplied does not differ from the one tested and that no listed RCRA hazardous wastes or Polychlorinated Biphenyls (PCBs) have been mixed with the product; and
  - a Safety Data Sheet.
2. Exception to T 59: In dilution, use 350 mL of distilled or deionized water and a 1,000-mL beaker.
  3. Use [Tex-238-F](#), beginning at "Particle Size Analysis by Laser Diffraction," with distilled or deionized water as a medium and no dispersant, or use another approved method.
  4. Exception to T 59: Leave sample in the oven until foaming ceases, then cool and weigh.
  5. PCE must meet either the kinematic viscosity requirement or the particle size requirement.

**Table 11A**  
**Hard Residue Surface Sealant**

| Property  | Test Procedure                         | Min               | Max |
|---|--|-------------------|-----|
| Viscosity, Krebs unit, 77°F, Krebs units  | D 562                                  | 45                | 75  |
| Softening point, °F   | <a href="#">Tex-505-C</a> <sup>1</sup> | 250               | –   |
| Uniformity  | D 2939                                 | Pass <sup>2</sup> |     |
| Resistance to heat  | D 2939                                 | Pass <sup>3</sup> |     |
| Resistance to water   | D 2939                                 | Pass <sup>4</sup> |     |
| Wet flow, mm  | D 2939                                 | –                 | 0   |
| Resistance to Kerosene (optional) <sup>5</sup>  | D 2939                                 | Pass <sup>6</sup> |     |
| Ultraviolet exposure, UVA-340, 0.77 W/m <sup>2</sup> , 50°C chamber, 8 hr. UV lamp, 5 min. spray, 3 hr. 55 min. condensation, 1,000 hr. total exposure <sup>7</sup> | G 154                                  | Pass <sup>8</sup> |     |
| Abrasion loss, 1.6 mm thickness, liquid only, %   | ISSA TB-100                            | –                 | 1.0 |
| Residue by evaporation, % by weight   | D 2939                                 | 33                | –   |
| Tests on residue from evaporation:<br>Penetration, 77°F, 100 g, 5 sec.<br>Flash point, Cleveland open cup, °F   | T 49<br>T 48                           | 15<br>500         | 30  |
| Tests on base asphalt before emulsification<br>Solubility in trichloroethylene, %   | T 44                                   | 98                | –   |

1. Cure the emulsion in the softening point ring in a 200°F ± 5°F oven for 2 hr.
2. Product must be homogenous and show no separation or coagulation that cannot be overcome by moderate stirring.
3. No sagging or slippage of film beyond the initial reference line.
4. No blistering or re-emulsification.
5. Recommended for airport applications or where fuel resistance is desired.
6. No absorption of Kerosene into the clay tile past the sealer film. Note sealer surface condition and loss of adhesion.
7. Other exposure cycles with similar levels of irradiation and conditions may be used with Department approval.
8. No cracking, chipping, surface distortion, or loss of adhesion. No color fading or lightening.

2.6.

**Recycling Agent.** Recycling agent and emulsified recycling agent must meet the requirements in Table 12. Additionally, recycling agent and residue from emulsified recycling agent, when added in the specified proportions to the recycled asphalt, must meet the properties specified on the plans.

**Table 12**  
**Recycling Agent and Emulsified Recycling Agent**

| Property   | Test Procedure | Recycling Agent |                  | Emulsified Recycling Agent (ARA-1) |                  | Polymer Modified Emulsified Recycling Agent (ARA-1P) |         |
|--|----------------|-----------------|------------------|------------------------------------|------------------|--|---------|
|  |                | Min             | Max              | Min                                | Max              | Min  | Max     |
| Viscosity, Saybolt Furol, 77°F, sec.   | T 72           | –               | –                | 15                                 | 100              | 15   | 110     |
| Sieve test, %  | T 59           | –               | –                | –                                  | 0.1              | –  | 0.1     |
| Miscibility <sup>1</sup>   | T 59           | –               |                  | No coagulation                     |                  |  |         |
| Residue by evaporation, <sup>2</sup> % by wt.  | T 59           | –               | –                | 60                                 | –                | –  | –       |
| Distillation test:<br>Residue by distillation, % by wt.<br>Oil distillate, % by volume of emulsion                                   | T 59           |                 |                  |                                    |                  | 60<br>–  | 65<br>2 |
| Penetration of Distillation Residue at 39.2°F, 100 g, 5 sec.   | T 49           |                 |                  |                                    |                  | 110  | 190     |
| Tests on recycling agent or residue from evaporation:<br>Flash point, C.O.C., °F<br>Kinematic viscosity,<br>140°F, cSt<br>275°F, cSt | T 48<br>T 201  | 400<br>75<br>–  | –<br>200<br>10.0 | 400<br>75<br>–                     | –<br>200<br>10.0 | 400  | –       |

1. Exception to T 59: Use 0.02 N CaCl<sub>2</sub> solution in place of water.
2. Exception to T 59: Maintain sample at 300°F until foaming ceases, then cool and weigh.

2.7. **Crumb Rubber Modifier.** Crumb rubber modifier (CRM) consists of automobile and truck tires processed by ambient temperature grinding.

CRM must be:

- free from contaminants including fabric, metal, and mineral and other nonrubber substances;
- free-flowing; and
- nonfoaming when added to hot asphalt binder.

Ensure rubber gradation meets the requirements of the grades in Table 13 when tested in accordance with [Tex-200-F](#), Part I, using a 50-g sample.

**Table 13**  
**CRM Gradations**

| Sieve Size<br>(% Passing) | Grade A |     | Grade B |     | Grade C |     | Grade D                  | Grade E     |
|---------------------------|---------|-----|---------|-----|---------|-----|--------------------------|-------------|
|                           | Min     | Max | Min     | Max | Min     | Max |                          |             |
| #8                        | 100     | –   | –       | –   | –       | –   | As shown on<br>the plans | As approved |
| #10                       | 95      | 100 | 100     | –   | –       | –   |                          |             |
| #16                       | –       | –   | 70      | 100 | 100     | –   |                          |             |
| #30                       | –       | –   | 25      | 60  | 90      | 100 |                          |             |
| #40                       | –       | –   | –       | –   | 45      | 100 |                          |             |
| #50                       | 0       | 10  | –       | –   | –       | –   |                          |             |
| #200                      | –       | –   | 0       | 5   | –       | –   |                          |             |

2.8. **Crack Sealer.** Provide polymer-modified asphalt-emulsion crack sealer meeting the requirements of Table 14. Provide rubber-asphalt crack sealer meeting the requirements of Table 15.



**Table 14**  
**Polymer-Modified Asphalt-Emulsion Crack Sealer**

| Property                           | Test Procedure            | Min    | Max    |
|------------------------------------|---------------------------|--------|--------|
| Rotational viscosity, 77°F, cP     | D 2196, Method A          | 10,000 | 25,000 |
| Sieve test, %                      | T 59                      | –      | 0.1    |
| Storage stability, 1 day, %        | T 59                      | –      | 1      |
| Evaporation                        | <a href="#">Tex-543-C</a> |        |        |
| Residue by evaporation, % by wt.   |                           | 65     | –      |
| Tests on residue from evaporation: |                           |        |        |
| Penetration, 77°F, 100 g, 5 sec.   | T 49                      | 35     | 75     |
| Softening point, °F                | T 53                      | 140    | –      |
| Ductility, 39.2°F, 5 cm/min., cm   | T 51                      | 100    | –      |

**Table 15**  
**Rubber-Asphalt Crack Sealer**

| Property   | Test Procedure            | Class A |     | Class B |      |
|--|---------------------------|---------|-----|---------|------|
|  |                           | Min     | Max | Min     | Max  |
| CRM content, Grade A or B, % by wt.  | <a href="#">Tex-544-C</a> | 22      | 26  | –       | –    |
| CRM content, Grade B, % by wt.   | <a href="#">Tex-544-C</a> | –       | –   | 13      | 17   |
| Virgin rubber content, <sup>1</sup> % by wt.                               |                           | –       | –   | 2       | –    |
| Flash point, <sup>2</sup> C.O.C., °F                                       | T 48                      | 400     | –   | 400     | –    |
| Penetration, <sup>3</sup> 77°F, 150 g, 5 sec.                              | T 49                      | 30      | 50  | 30      | 50   |
| Penetration, <sup>3</sup> 32°F, 200 g, 60 sec.                             | T 49                      | 12      | –   | 12      | –    |
| Softening point, °F  | T 53                      | –       | –   | 170     | –    |
| Bond Test, non-immersed, 0.5 in specimen, 50% extension, 20°F <sup>4</sup> | D5329                     | –       | –   | –       | Pass |

1. Provide certification that the Min % virgin rubber was added.
2. Agitate the sealing compound with a 3/8- to 1/2 in. (9.5- to 12.7 mm) wide, square-end metal spatula to bring the material on the bottom of the cup to the surface (i.e., turn the material over) before passing the test flame over the cup. Start at one side of the thermometer, move around to the other, and then return to the starting point using 8 to 10 rapid circular strokes. Accomplish agitation in 3 to 4 sec. Pass the test flame over the cup immediately after stirring is completed.
3. Exception to T 49: Substitute the cone specified in D 217 for the penetration needle.
4. Allow no crack in the crack sealing materials or break in the bond between the sealer and the mortar blocks over 1/4 in. deep for any specimen after completion of the test.

- 2.9. **Asphalt-Rubber Binders.** Provide asphalt-rubber (A-R) binders that are mixtures of asphalt binder and CRM, which have been reacted at elevated temperatures. Provide A-R binders meeting D6114 and containing a minimum of 15% CRM by weight. Provide Types I or II, containing CRM Grade C, for use in hot-mixed aggregate mixtures. Provide Types II or III, containing CRM Grade B, for use in surface treatment binder. Ensure binder properties meet the requirements of Table 16.

**Table 16  
A-R Binders**

| Property  | Test Procedure  | Binder Type |       |         |       |          |       |
|---|-----------------|-------------|-------|---------|-------|----------|-------|
|   |                 | Type I      |       | Type II |       | Type III |       |
|   |                 | Min         | Max   | Min     | Max   | Min      | Max   |
| Apparent viscosity, 347°F, cP                                     | D2196, Method A | 1,500       | 5,000 | 1,500   | 5,000 | 1,500    | 5,000 |
| Penetration, 77°F, 100 g, 5 sec.                                  | T 49            | 25          | 75    | 25      | 75    | 50       | 100   |
| Penetration, 39.2°F, 200 g, 60 sec.                               | T 49            | 10          | –     | 15      | –     | 25       | –     |
| Softening point, °F   | T 53            | 135         | –     | 130     | –     | 125      | –     |
| Resilience, 77°F, %   | D5329           | 25          | –     | 20      | –     | 10       | –     |
| Flash point, C.O.C., °F   | T 48            | 450         | –     | 450     | –     | 450      | –     |
| Tests on residue from Thin-Film Oven Test:                        | T 179           |             |       |         |       |          |       |
| Retained penetration ratio, 39.2°F, 200 g, 60 sec., % of original | T 49            | 75          | –     | 75      | –     | 75       | –     |

- 2.10. **Performance-Graded Binders.** Provide PG binders that are smooth and homogeneous, show no separation when tested in accordance with [Tex-540-C](#), and meet the requirements of Table 17.

Separation testing is not required if:

- a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer,
- the binder is blended on site in continuously agitated tanks, or
- binder acceptance is based on field samples taken from an in-line sampling port at the hot-mix plant after the addition of modifiers.

**Table 17**  
**Performance-Graded Binders**

| Property and Test Method  | Performance Grade |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
|---|-------------------|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|
|   | PG 58             |     |     | PG 64 |     |     |     | PG 70 |     |     |     | PG 76 |     |     |     | PG 82 |     |     |
|   | -22               | -28 | -34 | -16   | -22 | -28 | -34 | -16   | -22 | -28 | -34 | -16   | -22 | -28 | -34 | -16   | -22 | -28 |
| Average 7-day max pavement design temperature, °C <sup>1</sup>  | 58                |     |     | 64    |     |     |     | 70    |     |     |     | 76    |     |     |     | 82    |     |     |
| Min pavement design temperature, °C <sup>1</sup>  | -22               | -28 | -34 | -16   | -22 | -28 | -34 | -16   | -22 | -28 | -34 | -16   | -22 | -28 | -34 | -16   | -22 | -28 |
| <b>Original Binder</b>  |                   |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
| Flash point, T 48, Min, °C  | 230               |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
| Viscosity, T 316 <sup>2,3</sup> :<br>Max, 3.0 Pa s, test temperature, °C  | 135               |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
| Dynamic shear, T 315 <sup>4</sup> :<br>G*/sin(δ), Min, 1.00 kPa, Max, 2.00 kPa <sup>7</sup> ,<br>Test temperature @ 10 rad/sec., °C | 58                |     |     | 64    |     |     |     | 70    |     |     |     | 76    |     |     |     | 82    |     |     |
| Elastic recovery, D6084, 50°F, % Min <sup>8</sup>   | -                 | -   | 30  | -     | -   | 30  | 50  | -     | 30  | 50  | 60  | 30    | 50  | 60  | 70  | 50    | 60  | 70  |
| <b>Rolling Thin-Film Oven (Tex-506-C)</b>   |                   |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
| Mass change, T 240, Max, %  | 1.0               |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
| Dynamic shear, T 315:<br>G*/sin(δ), Min, 2.20 kPa, Max, 5.00 kPa <sup>7</sup> ,<br>Test temperature @ 10 rad/sec., °C               | 58                |     |     | 64    |     |     |     | 70    |     |     |     | 76    |     |     |     | 82    |     |     |
| MSCR, T350, Recovery, 0.1 kPa, High Temperature, % Min <sup>8</sup>   | -                 | -   | 20  | -     | -   | 20  | 30  | -     | 20  | 30  | 40  | 20    | 30  | 40  | 50  | 30    | 40  | 50  |
| <b>Pressure Aging Vessel (PAV) Residue (R 28)</b>   |                   |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
| PAV aging temperature, °C   | 100               |     |     |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |
| Dynamic shear, T 315:<br>G*/sin(δ), Max, 5,000 kPa<br>Test temperature @ 10 rad/sec., °C  | 25                | 22  | 19  | 28    | 25  | 22  | 19  | 28    | 25  | 22  | 19  | 28    | 25  | 22  | 19  | 28    | 25  | 22  |
| Creep stiffness, T 313 <sup>5,6</sup> :<br>S, max, 300 MPa,<br>m-value, Min, 0.300<br>Test temperature @ 60 sec., °C                | -12               | -18 | -24 | -6    | -12 | -18 | -24 | -6    | -12 | -18 | -24 | -6    | -12 | -18 | -24 | -6    | -12 | -18 |
| Direct tension, T 314 <sup>6</sup> :<br>Failure strain, min, 1.0%<br>Test temperature @ 1.0 mm/min., °C                             | -12               | -18 | -24 | -6    | -12 | -18 | -24 | -6    | -12 | -18 | -24 | -6    | -12 | -18 | -24 | -6    | -12 | -18 |

- Pavement temperatures are estimated from air temperatures and using an algorithm contained in a Department-supplied computer program, may be provided by the Department, or by following the procedures outlined in AASHTO MP 2 and PP 28.
- This requirement may be waived at the Department's discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed, and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).
- Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.
- For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of G\*/sin(δ) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).
- Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.
- If creep stiffness is below 300 MPa, direct tension test is not required. If creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The m value requirement must be satisfied in both cases.
- Maximum values for unaged and RTFO aged dynamic shear apply only to materials used as substitute binders, as described in Item 340, "Dense-Graded Hot-Mix Asphalt (Small Quantity)", Item 341, "Dense-Graded Hot-Mix Asphalt, and Item 344, "Superpave Mixtures."
- Elastic Recovery (ASTM D6084) is not required unless MSCR (AASHTO T 350) is less than the minimum % recovery. Elastic Recovery must be used for the acceptance criteria in this instance.

### 3. EQUIPMENT

Provide all equipment necessary to transport, store, sample, heat, apply, and incorporate asphalts, oils, and emulsions.

#### 4. CONSTRUCTION

**Typical Material Use.** Use materials shown in Table 18, unless otherwise determined by the Engineer.

**Table 18**  
**Typical Material Use**

| Material Application                  | Typically Used Materials   |
|---------------------------------------|--|
| Hot-mixed, hot-laid asphalt mixtures  | PG binders, A-R binders Types I and II   |
| Surface treatment                     | AC-5, AC-10, AC-15P, AC-20XP, AC-10-2TR, AC-20-5TR, HFRS-2, MS-2, CRS-2, CRS-2H, CRS-2TR, CMS-2P HFRS-2P, CRS-2P, CHFRS-2P, A-R binders Types II and III |
| Surface treatment (cool weather)      | AC12-5TR, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, MC-2400L, CMS-2P   |
| Precoating                            | AC-5, AC-10, PG 64-22, SS-1, SS-1H, CSS-1, CSS-1H  |
| Tack coat                             | PG Binders, SS-1H, CSS-1H, EAP&T, TRAIL, EBL   |
| Fog seal                              | SS-1, SS-1H, CSS-1, CSS-1H, CMS-1P   |
| Hot-mixed, cold-laid asphalt mixtures | AC-0.6, AC-1.5, AC-3, AES-300, AES-300P, CMS-2, CMS-2S   |
| Patching mix                          | MC-800, SCM I, SCM II, AES-300S  |
| Recycling                             | AC-0.6, AC-1.5, AC-3, AES-150P, AES-300P, recycling agent, emulsified recycling agent  |
| Crack sealing                         | SS-1P, polymer mod AE crack sealant, rubber asphalt crack sealers (Class A, Class B)   |
| Microsurfacing                        | CSS-1P   |
| Prime                                 | MC-30, AE-P, EAP&T, PCE  |
| Curing membrane                       | SS-1, SS-1H, CSS-1, CSS-1H, PCE  |
| Erosion control                       | SS-1, SS-1H, CSS-1, CSS-1H, PCE  |
| FDR -Foaming                          | PG 64-22, FDR EM-SY, FDR EM-HY   |

- 4.1. **Storage and Application Temperatures.** Use storage and application temperatures in accordance with Table 19. Store and apply materials at the lowest temperature yielding satisfactory results. Follow the manufacturer's instructions for any agitation requirements in storage. Manufacturer's instructions regarding recommended application and storage temperatures supersede those of Table 19.

**Table19**  
**Storage and Application Temperatures**

| Type-Grade  | Application            |                    | Storage Max (°F) |
|---|------------------------|--------------------|------------------|
|   | Recommended Range (°F) | Max Allowable (°F) |                  |
| AC-0.6, AC-1.5, AC-3  | 200–300                | 350                | 350              |
| AC-5, AC-10   | 275–350                | 350                | 350              |
| AC-15P, AC-20-5TR, AC12-5TR and AC10-2TR  | 300–375                | 375                | 360              |
| RC-250  | 125–180                | 200                | 200              |
| RC-800  | 170–230                | 260                | 260              |
| RC-3000   | 215–275                | 285                | 285              |
| MC-30, AE-P   | 70–150                 | 175                | 175              |
| MC-250  | 125–210                | 240                | 240              |
| MC-800, SCM I, SCM II   | 175–260                | 275                | 275              |
| MC-3000, MC-2400L   | 225–275                | 290                | 290              |
| HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P, CMS-2, CMS-2S, AES-300, AES-300S, AES-150P, AES-300P, CRS-2TR                                     | 120–160                | 180                | 180              |
| SS-1, SS-1H, CSS-1, CSS-1H, PCE, EAP&T, SS-1P, RS-1P, CRS-1P, CSS-1P, recycling agent, emulsified recycling agent, polymer mod AE crack sealant | 50–130                 | 140                | 140              |
| PG binders  | 275–350                | 350                | 350              |
| Rubber asphalt crack sealers (Class A, Class B)   | 350–375                | 400                | –                |
| A-R binders Types I, II, and III  | 325–425                | 425                | 425              |

## 5. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but is subsidiary or is included in payment for other pertinent items.

# Special Specification 6185

## Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)




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### 1. DESCRIPTION

Furnish, operate, maintain and remove upon completion of work, Truck Mounted Attenuator (TMA) or Trailer Attenuator (TA).

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### 2. MATERIALS

Furnish, operate and maintain new or used TMAs or TAs. Assure used attenuators are in good working condition and are approved for use. A list of approved TMA/TA units can be found in the Department's Compliant Work Zone Traffic Control Devices List. The host vehicle for the TMA and TA must weigh a minimum of 19,000 lbs. Host vehicles may be ballasted to achieve the required weight. Any weight added to the host vehicle must be properly attached or contained within it so that it does not present a hazard and that proper energy dissipation occurs if the attenuator is impacted from behind by a large truck. The weight of a TA will not be considered in the weight of the host vehicle but the weight of a TMA may be included in the weight of the host vehicle. Upon request, provide either a manufacturer's curb weight or a certified scales weight ticket to the Engineer.

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### 3. CONSTRUCTION

Place or relocate TMA/TAs as shown on the plans or as directed. The plans will show the number of TMA/TAs needed, for how many days or hours, and for which construction phases.

Maintain the TMA/TAs in good working condition. Replace damaged TMA/TAs as soon as possible.

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### 4. MEASUREMENT

4.1. **Truck Mounted Attenuator/Trailer Attenuator (Stationary).** This Item will be measured by the each or by the day. TMA/TAs must be set up in a work area and operational before a calendar day can be considered measurable. When measurement by the day is specified, a day will be measured for each TMA/TA set up and operational on the worksite.

4.2. **Truck Mounted Attenuator/Trailer Attenuator (Mobile Operation).** This Item will be measured by the hour. The time begins once the TMA/TA is ready for operation at the predetermined site and stops when notified by the Engineer. A minimum of 4 hr. will be paid each day for each operating TMA/TA used in a mobile operation.

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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 "Truck Mounted Attenuators/Trailer Attenuators (Stationary)," or "Truck Mounted Attenuators/Trailer Attenuators (Mobile Operation)." This price is full compensation for furnishing TMA/TA: set up; relocating; removing; operating; fuel; and equipment, materials, tools, labor, and incidentals.