

**METROPOLITAN WASHINGTON AIRPORTS AUTHORITY
DULLES TOLL ROAD**

STATEMENT OF WORK

ON-CALL PAVEMENT MAINTENANCE AND REPAIR SERVICES

October 2018

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1.0 INTRODUCTION

The Metropolitan Washington Airports Authority is responsible for the operations, maintenance, and repair of the Dulles Toll Road (referred to herein as “DTR”). The Airport Authority’s headquarters is located at 1 Aviation Circle, Washington, D.C. (referred to herein as “COB”). This Statement of Work addresses services, which are to be performed on the DTR.

The requirements in this SOW include, but are not limited to repairs to the following items: bituminous and Portland Cement Concrete, concrete decks / pads, curb, gutter and sidewalk repairs. These repairs also include incidental items associated with the Dulles Toll Road, concrete pads at toll booths and the toll road administration building parking lot. Drainage ditches, wash outs and soil erosion will need to be repaired following VDOT guidelines & specifications.

2.0 DEFINITIONS

CONTRACTING OFFICER (CO)

The Contracting Officer (CO) is the individual responsible for executing all contractual aspects, such as the terms, scope, price, or conditions of this contract on behalf of the Authority.

CONTRACTING OFFICER’S TECHNICAL REPRESENTATIVE (COTR)

The Contracting Officer’s Technical Representative (COTR) is an Authority employee, designated by the Contracting Officer to ensure the terms of the contract are being met by the Contractor. The COTR can **NOT** change the terms, scope, price, or conditions of this contract, but will be issuing Call Orders under this contract.

CONTRACTOR

Pertaining to this document, the word “**CONTRACTOR**” refers to the company awarded this contract. It also defines all personnel and subcontractors or suppliers hired by the Contractor to perform any services specified within this contract.

CONTRACT TASK ORDER (CTO)

A document authorizing the contractor to perform services as outlined in the statement of work. For the purpose of this particular statement of work, the weekly schedule issued by the COTR shall be considered the contract task order.

IAD

Abbreviation for Washington Dulles International Airport.

DTR

Abbreviation for Dulles Toll Road.

METROPOLITAN WASHINGTON AIRPORTS AUTHORITY (MWAA)

Metropolitan Washington Airports Authority is the governing body which operates Washington Dulles International Airport. Also referred to as “the Airports Authority”.

PCC

Portland Cement Concrete

Temporary Traffic Control plan (TTC)

Temporary traffic control plan used to show how lanes and ramps will be closed following the MUTCD & VWAPM guidelines.

QUALITY ASSURANCE (QA)

Quality Assurance is a program used by the Authority to ensure the Contractor is providing the services of this contract as defined by the contract specifications.

QUALITY CONTROL (QC)

Quality Control is a program designed by the contractor to monitor its performance in this contract to ensure services are provided on a consistent standard at all times.

Virginia Work Area Protection Manual (VWAPM)

Manual issued to promote a uniform standard of traffic control associated with special events, incident management, and work area protection along the highways of Virginia.

Manual on Uniform Traffic Devices (MUTCD)

Traffic control devices shall be defined as all signs, signals, marking, and other devices used to regulate, warn, or guide traffic, on any roadway.

3.0 STATEMENT OF WORK

The Contractor shall provide maintenance services with all necessary labor, materials, tools, equipment with operator, and supervision to perform roadway, concrete decks, parking lot, sidewalk, curb and gutter, and pavement. Also associated roadway incidental maintenance and repairs, including culvert maintenance and erosion repair around guardrail posts, sound walls, shoulder embankments, slopes, ditches, drainage outfalls, and roadway pavement sections along the Dulles Toll Road (DTR) and its access ramps. The Contractor shall perform specified maintenance and repairs based on a contract task order issued by the (COTR). The COTR shall determine the type of repair for each contractor work assignment and issue a contract task order to the Contractor. The COTR shall approve any changes to the contract task order once it has been issued to the Contractor. Work tasks commonly associated with each repair shall include mobilization, Demobilization, traffic control, and **thorough cleanup**, which shall be the responsibility of the Contractor. The contractor shall follow the current addition of the Virginia Work Area Protection Manual “VWAPM” & the Manual on Uniform Traffic Devices “MUTCD”. Failure to follow both the VWAPM & the MUTCD may result in a safety stand down. In this event the contractor will be told to halt all work in that area until the problem has been resolved to the satisfaction of the COTR or DTR operations

team. The mobilization has a set cost of \$500 dollars in the price schedule that must be approved by the COTR before any mobilization can begin.

- 3.1 Work location, limits of construction, and work scope description shall be specified by the COTR prior to commencement of each work assignment, unless otherwise instructed by the COTR. The maintenance services on the DTR roadways shall be performed between the hours of 10:00am to 3:30pm daily and between the hours of 9:30pm and 5:00am for night work. The contractor shall call into the DTR operations control room at the start and end of every shift day or night. The control room is staffed 24-7 and will be able to open and close lanes and give guidance if a problem arises during that shift.
- 3.2 All excavated and/or demolished material shall be removed and disposed of off DTR property by the Contractor to an approved disposal site at the end of each workday. The Contractor shall comply with all federal, state, and local rules and regulations governing the handling and disposal of excavated and/or demolished materials. It shall be the contractor's responsibility to verify and record existing lines, grades and elevations prior to making any repairs. **The contractor will be responsible for locating all utilities inside any work area.** Areas disturbed by the contractor outside the limits of construction shall be restored to their original condition at the contractor's expense. All repair work shall be completed in accordance with the contract specifications.

4.0 CONTRACTOR MATERIAL AND PERFORMANCE REQUIREMENTS

Materials and services provided under this contract shall be performed in accordance with the current edition and revisions to the Virginia Department of Transportation (VDOT) Road and Bridge Specifications, attached exhibits and the following:

- 4.1 Mobilization costs are listed in the Cost Schedule. This work shall consist of performing preparatory operations, including moving personnel and equipment to and from the project site.
- 4.2 Pavement milling shall be accomplished by mechanical means specifically designed for pavement milling operations. Spoil material generated from the pavement milling operations shall be removed from the DTR daily. Milling depth and pavement overlays may be up to three inches. Any damage that occurs during operations on the DTR will be the contractor's responsibility to have fixed at no extra cost to the DTR.
- 4.3 Pothole repair depth for bituminous pavement shall be up to 14 inches. Use approved plant-produced patching mixture as fill material for pothole repairs. Cold patch materials may be used as directed by the COTR. **Pot holes shall be repaired within a 24 hours period after reporting.**

- 4.4 For bituminous concrete pavement repairs see Appendix E-Pavement and Exhibit P-603 Bituminous Tack Coat. For overlays, the bituminous concrete surface (wearing) course shall be two inches thick and shall be VDOT Super pave Type SM12.5D or mix equivalent unless otherwise instructed by the COTR.
- 4.5 For Portland Cement Concrete repairs: Partial depth PCC pavement repairs shall be in accordance with Exhibit PCC-1, Portland Cement Concrete Partial Depth Repair. The Contractor shall be responsible for supplying the necessary water where a DTR connection is not available. Joint Sealing Filler shall conform to Exhibit P-605, (Joint Sealing Filler).
- 4.6 For crack sealing repairs for bituminous concrete surfaces see Exhibit CS-1.
- 4.7 For crack sealing repairs for PCC surfaces see Exhibit CS-2.
- 4.8 Curb, Gutter and Sidewalk repair shall follow VDOT Road and Bridge Specification Section 508 (Demolition of Pavement and Obscuring Roadway) and Exhibit CSR-1 (Curb and Sidewalk Repair).
- 4.9 Approach slabs / deck repairs shall follow VDOT Road and Bridge Specification Section 316 Hydraulic Cement Concrete Pavement.
- 4.10 In performing services under this contract, the contractor shall maintain and control traffic in accordance with the Commonwealth of Virginia and the Manual of Uniform Traffic Control Devices. The contractor may be required to submit a traffic control plan to the COTR for review and approval prior to performing any repair work. The contractor shall call into the DTR operations control room at the start and end of every shift. The contractor may be asked to halt work if any part of the traffic control is deemed unsafe by the COTR or DTR operations. The contractor will not be reimbursed for any time or materials lost due to the halting of work.
- 4.11 For bituminous mill and overlays, a hot-applied pavement joint adhesive shall be applied to longitudinal construction joints. Joint adhesive shall be heated and applied in accordance with the manufacturer's specifications.
- 4.12 Supervision shall be performed by the contractor. The contractor's supervisor shall be responsible for maintaining control of the contractor's personnel and equipment, fueling, and maintaining contractor-owned equipment. The supervisor must also monitor traffic control and lane closer set up, to ensure that cones, signs and other lane closer apparatus remain intact. As they maybe knocked or blown over in the course of operations.
- 4.13 The Contractor shall provide material testing and quality control for all repair work. Additionally, the COTR or a third-party inspection agency designated by the COTR will perform inspections.

- 4.14 The Contractor shall provide submittals in accordance with the specification requirements. A Temporary Traffic Control plan (TTC) shall be submitted to the COTR for approval whenever a lane closer or detour is needed.
- 4.15 Hotbox shall be between two and four tons. Truck mounted or trailer mounted. Propane or Diesel fired. The hotbox will only be used when directed by the COTR. The Hotbox item in the cost schedule will include mobilization/demobilization and all operational costs, to include pick up and storage of asphalt.
- 4.16 Inlets and culverts will be approved on an as-needed basis and will make up less than 20% of the contract. Labor will consist of a four person crew with one supervisor and three workers. Equipment allowance will be for Skid steer loaders, backhoes, compactors/Hydraulic plate tamper, mini excavator, and Ride-on trenchers 35-50hp.
- 4.17 The contractor shall provide all materials and parts necessary for maintenance/repair of the roadway under this contract. All replacement materials, parts, and units shall be the same as the existing or an approved equal (approved by the COTR). Approved replacement parts shall be billed to the Airports Authority at the Contractor's actual invoice cost plus 10%. There will be no mark-up for shipping, handling or taxes. Parts and materials shall be itemized on the contractor's invoice with back-up documentation of the contractor's cost.

5.0 TRAFFIC CONTROL

The Contractor shall keep the portions of the road being used by the public free from irregularities and obstructions that could present a hazard or annoyance to traffic. Holes in hard surface pavements shall be filled with approved asphalt patching material. When emergency patching is needed, the contractor may need help from MWAA PD, to control traffic at night or during peak hours. All cost for having law enforcement help with traffic control will be the contractor's responsibility.

- 5.1 Detours may be indicated on the plans or in the special provisions or used with the approval of the COTR. Detours over existing roads will be designated, marked, and maintained by the contractor. The provision of detours and marking of alternate routes will not relieve the contractor of the responsibility for ensuring the safety of the public. Nor will it relieve the contractor from complying with any requirements of these specifications affecting the rights of the public, including those concerning lights and barricades. Maintenance of all detours shall be the responsibility of the contractor. The contractor shall be required to set up and taken down the detour/ lane closures each work shift. This would also include any equipment the contractor would have on site. Unless given written permission by the COTR everything must be removed from the DTR at the close of each work shift.

- 5.2 Maintenance of Traffic during Suspension of Work: During any suspension of work, the Contractor shall temporarily open to traffic such portions of the project and temporary roadways as may be agreed on by the Contractor and COTR.
- 5.3 Lane Closures: Only two lanes shall be closed at one given time on the main line. Only one lane will be given at a time at each booth location. If multiple lanes are in need of repair it shall be completed in stages, maintaining the two lane closure. Most work operations will have to be scheduled during off-peak hours. Night work will be required in some locations on the DTR.
- 5.4 Flagging Traffic: Certified flaggers shall be provided in sufficient number and locations as necessary for control and protection of vehicular and pedestrian traffic in accordance with the requirements of *MUTCD*. Flaggers shall use sign paddles to regulate traffic in accordance with the requirements of *MUTCD*.
- 5.5 Delays: Unless otherwise approved, traffic shall be maintained at all times. The contractor shall not stop traffic without permission. If stopping traffic is approved, the contractor shall provide flaggers to direct the traffic.
- 5.6 Exits and Entrances: Exits and entrances shall be kept in a reasonably smooth condition at all times. Exits or entrances shall not be disturbed by the Contractor until necessary. Once exits or entrances have been disturbed, they shall be maintained and completed as follows
 - 5.6.1 Exits: Exits that had an original paved surface shall be brought to final grade through the intersection. The exit lanes shall be paved as soon as possible after exits are disturbed. If there are delays in prosecution of work for exits, exits shall have the lanes maintained with a temporary paved surface.
 - 5.6.2 Entrances: Entrances shall be graded concurrently with the roadway with which they intersect. Once an entrance has been disturbed, it shall be completed as soon as is practicable, including placing the required base and surface course or stabilization. If the entrance must be constructed in stages, such as when there is a substantial change in the elevation of the roadway with which it intersects, the surface shall be maintained with a temporary paved surface until the entrance can be completed and the required base and surface or stabilization course can be placed.

6.0 MEASUREMENT and PAYMENT

Measurement and payment for each line item shall be made as indicated on the cost schedule and as indicated in the specifications. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of materials, and for all labor, equipment with operator, tools, and incidentals necessary to complete the item in

accordance with the contract documents. Payment shall be made for actual quantities of service performed and may not exceed the specified rate defined in the Cost Schedule. Cost Schedule individual unit measurements are estimates only. Actual amounts of linear feet, square footage, etc., may exceed or be less than the estimated amounts. Approved replacement parts that are not listed in the cost schedule shall be billed to the Airports Authority at the contractor's actual invoice cost plus 10%. There will be no mark-up for shipping & handling or taxes. Parts and materials shall be itemized on the contractor's invoice with back-up documentation of the contractor's cost. The Airports Authority strives to pay all invoices within 30 days from the date the invoice is submitted to Invoices, MWAA MWAA.Invoices@MWAA.com please copy the COTR and CO on all invoices when submitted to MWAA. Invoices.

7.0 SAFETY AND PROTECTION

- 7.1 The contractor shall be responsible for researching, understanding, administering, and practicing the environmental protection, safety and health provisions of the Airports Authority Construction Safety Manual, Occupational Safety and Health Administration (OSHA) and other applicable federal, state and local standards.
- 7.2 The contractor shall strictly follow the uniform standard of temporary traffic control as outlined in the Virginia Work Area Protection Manual, Standards and Guidelines for Temporary Traffic Control. Construction signage warning motorists of "Work Ahead", must be used in all locations.
- 7.3 The contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the contract. The contractor shall take all necessary precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to persons, properties, equipment, and vehicles.
- 7.4 The contractor shall immediately notify the COTR of any damage to any vehicles or property caused by or involving contractor equipment or personnel. The contractor shall immediately submit a written incident report to the COTR. Damage caused by the contractor to any properties shall be repaired or replaced to the satisfaction of the Airports Authority at the expense of the contractor. The Airports Authority, at its sole discretion, may elect to repair or replace the damaged property, and deduct such costs from monies due the contractor. The Airports Authority shall notify the contractor of any damage caused by contractor equipment or personnel, promptly after the Airports Authority discovers the same or receives notice thereof.

8.0 SECURITY REQUIREMENTS

The Contractor, its subcontractors, and all its employees shall be subject to, and shall at all times conform with, any and all rules, regulations, policies and procedures pertaining

to security at the Dulles Toll Road. Any violations or disregard of the rules, regulations, policies and procedures may be cause for immediate termination.

9.0 QUALITY CONTROL REQUIREMENTS

The contractor shall provide material and quality control (QC) testing for the services performed in accordance with VDOT specifications. Services which fail to meet the material and QC testing requirements shall be removed and replaced at the Contractor's expense.

METROPOLITAN WASHINGTON AIRPORTS AUTHORITY
DULLES TOLL ROAD, MA-240

CONTRACT SERVICES CALL ORDER

| | | |
|---------------|-----------------------------------|----------------------|
| Type of Work: | On-Call Pavement Marking Services | Date Prepared: _____ |
| Prepared by: | _____ | Contract # : _____ |
| Contractor: | _____ | POC: _____ |
| Address: | _____ | Office Phone # _____ |
| | _____ | Cell Phone # _____ |
| | | Fax # _____ |

Location and Description of Work _____

MWAA ESTIMATOR _____

CONTRACTOR ESTIMATOR _____

| WORK ITEM | QUANTITY | UNIT OF MEASURE | UNIT COST | AMOUNT |
|-----------------------------|----------|-----------------|-----------|---------------|
| | | | | \$0.00 |
| | | | | \$0.00 |
| | | | | \$0.00 |
| | | | | \$0.00 |
| | | | | \$0.00 |
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| | | | | \$0.00 |
| | | | | \$0.00 |
| | | | | \$0.00 |
| | | | | \$0.00 |
| | | | | \$0.00 |
| TOTAL ESTIMATED COST | | | | \$0.00 |

APPROVAL AND ACCEPTANCE

Call Order #

| | | | |
|---------------------|-------|----------------|----------------|
| APPROVED BY: | | START DATE | ____/____/____ |
| COTR | _____ | DATE | ____/____/____ |
| CONTRACTOR | _____ | DATE | ____/____/____ |
| ACCEPTED BY: | | DATE COMPLETED | ____/____/____ |
| COTR | _____ | DATE | ____/____/____ |
| CONTRACTOR | _____ | DATE | ____/____/____ |
| INSPECTOR | _____ | DATE | ____/____/____ |

REMARKS:

BY SIGNING THIS CALL ORDER, THE CONTRACTOR ACKNOWLEDGES THAT HE/SHE WILL ONLY PERFORM WORK DESCRIBED AFTER THIS CALL ORDER IS APPROVED BY THE COTR. IN ADDITION, THE COST TO THE AUTHORITY SHALL NOT EXCEED THE "TOTAL ESTIMATED COST" NOTED ABOVE. ANY CHANGES MUST BE PRE-APPROVED BY THE COTR.

APPENDIX E

PAVEMENT SEPCIFICATIONS

PAVEMENT MATERIAL SPECIFICATIONS

PAVEMENT MATERIALS SPECIFICATIONS

The pavement materials specifications for the milling and replacing rehabilitation are listed below.

| Section No. | Section Title |
|--------------------|--|
| Section 02210 | Asphalt Materials |
| Section 02211 | Asphalt Concrete |
| Section 02212 | Joint Materials |
| Section 02304 | Construction of Density Control Strips |
| Section 02310 | Tack Coat |
| Section 02315 | Asphalt Concrete Pavement |
| Section 02317 | Asphalt Pavement Milling |
| Section 02509 | Asphalt Pavement Patching |

SECTION 02210 - ASPHALT MATERIALS**Sec. 02210.01-Description.**

These specifications cover asphalt material consisting of asphalt, asphalt cement, asphalt cutback, or asphalt emulsion as defined in ASTM D8.

Sec. 02210.02-Materials.

Asphalt material shall be homogeneous and shall conform to the following:

1. Rapid curing and medium curing liquid asphalts used as surface treatments shall contain a heat-stable additive conforming to the requirements of Section 02211 "Asphalt Concrete".
2. Liquid asphalt material will be tested for coating ability in accordance with AASHTO T182, with the following modifications:
 - a. Material that can coat 95 percent of a shady dolomite will be classified Type I.
 - b. Material that can coat 95 percent of a siliceous gravel wetted with 2 percent water by weight will be classified Type II.
3. Rapid curing cutback asphalts shall conform to the requirements of AASHTO M81.
4. Medium curing cutback asphalts shall conform to the requirements of AASHTO M82.
5. Cements shall be viscous graded conforming to the requirements of AASHTO M226, Table 2, except that the loss on heating shall be not greater than 1.0 for AC-5, 0.8 for AC-20 and 0.5 for all other grades.
6. Emulsions shall conform to the requirements of AASHTO M208 and shall be Type I as specified in 2.a. herein except that CRS-2 shall be Type II as specified in 2.b. herein. CRS-1h shall conform to the requirements of AASHTO M208 for CRS-1 except that the penetration shall be 40 to 110. Emulsions shall be sampled and tested in accordance with AASHTO T59 except that viscosity will be tested in accordance with VTM 64.

Sec. 02210.03-Detail Requirements.

- (a) **Shipping:** Shipments of asphalt material shall be made in transporting media that are free from contamination. Tank trucks or trailers shall be equipped with a sampling device approved by COTR. The device shall have an inside diameter of 1/2 to 1 inch and a gate valve or petcock. The device shall be built into the tank or the recirculating or discharge line so that a sample can be drawn during circulation or discharge.
- (b) **Storing:** Asphalt material to be stored shall be placed in storage tanks that are free from contamination.

Sec. 02210.04-Payment Adjustment System.

If the material represented by any one sample does not conform to the requirements herein and the material is a pay item, the contract unit price for the item will be reduced by 4 percent for each property that does not conform to the specifications for the quantity represented by the sample that was used on the project. Unused material represented by the failing sample will be rejected.

END OF SECTION 02210

SECTION 02211 - ASPHALT CONCRETE

Sec. 02211.01—Description

Asphalt concrete shall consist of a combination of mineral aggregate and asphalt material mixed mechanically in a plant specifically designed for such purpose.

An equivalent single axle load (ESAL) will be established by the COTR and SUPERPAVE mix types may be specified as one of the types listed as follows:

| Mix Type | Equivalent Single Axle Load (ESAL) Range (millions) | Asphalt Performance Grade (PG) | Aggregate Nominal Maximum Sieve in.* |
|-----------|---|--------------------------------|--------------------------------------|
| SM-9.0 A | 0 to 3 | 64-16 | 3/8" |
| SM-9.0 D | 3 to 10 | 70-16 | 3/8" |
| SM-9.0 E | Above 10 | 76-22 | 3/8" |
| SM-9.5 A | 0 to 3 | 64-16 | 3/8" |
| SM-9.5 D | 3 to 10 | 70-16 | 3/8" |
| SM-9.5 E | Above 10 | 76-22 | 3/8" |
| SM-12.5 A | 0 to 3 | 64-16 | 1/2" |
| SM-12.5 D | 3 to 10 | 70-16 | 1/2" |
| SM-12.5 E | Above 10 | 76-22 | 1/2" |
| IM-19.0 A | Less than 10 | 64-16 | 3/4" |
| IM-19.0 D | 10 and above | 70-16 | 3/4" |
| BM-25.0A | All ranges | 64-16 | 1" |
| BM-25.0D | Above 10 | 70-16 | 1" |

Asphalt Concrete shall conform to the requirements for the type designated.

*Nominal Maximum Size is defined as one sieve size larger than the first sieve to retain more than 10 percent aggregate.

* Minimum Asphalt Performance Grade (PG) is defined as the minimum binder performance grade for the job mixes as determined by AASHTO T170 or AASHTO M320.

Sec. 02211.02 -- Materials.

- (a) Asphalt materials shall conform to the requirements of Section 02210 "Asphalt Material" of the Specifications except asphalt cement materials shall be Performance Graded (PG) conforming to the requirements of AASHTO Provisional Specification MP-1.
- (b) Coarse aggregate shall be Grade A or B, conforming to all requirements (except grading) of Section 02203 "Coarse Aggregate" of the Specifications for quality. In addition, the coarse aggregate sizes retained on and above the No. 4 sieve shall meet the coarse aggregate requirements in the aggregate properties, Table 12A. Flat and Elongated (F&E) shall be tested in accordance with ASTM D 4791 and coarse aggregate angularity (CAA) shall be tested, on crushed gravel only, in accordance with ASTM D 5821.
- (c) Fine aggregate shall conform to the requirements (except grading) of Section 02202, "Fine Aggregate" of the Specifications for quality and the fine aggregate requirements in Table II-12A. Fine aggregate angularity (FAA) shall be tested in accordance with AASHTO T 304 (Method A) and sand equivalent (SE) in accordance with AASHTO T 176.
- (d) After performing a gradation:
 - 1. If 10 percent or more of the material is retained on the No. 4 sieve, then that portion will be tested in accordance with Section 02211.02 (b) herein.
 - 2. If 10 percent or more of the material passes the No. 4 sieve, then that portion will be tested for Sand Equivalent.
 - 3. If 10 percent or more of the material passes the No. 8 sieve, then that portion will be tested for Fine Aggregate Angularity.
- (e) Fine or coarse aggregates that tend to polish under traffic will not be permitted in any final surface exposed to traffic.
- (f) Mineral filler shall conform to the requirements of Section 02201 "Mineral Filler" of the Specifications.
- (g) Aggregate for asphalt concrete shall be provided in sufficient sizes to produce a uniform mixture. The Contractor shall indicate on the proposed job-mix formula the separate approximate sizes of aggregate to be used.

Where segregation or nonuniformity is evident in the finished pavement, the COTR reserves the right to require the Contractor to discontinue the use of crusher run or aggregate blends and to furnish separate sizes of open graded aggregate material.

- (h) An antistripping additive shall be used in all asphalt mixes. It may be hydrated lime in accordance with the requirements of Section 02211.02 (i) herein.

The mixture shall produce a tensile strength ratio (TSR) value not less than 0.80 for the design and production tests. The TSR value shall be determined in accordance with AASHTO T 283, including a freeze-thaw cycle, (4 inch specimens compacted with Marshall hammer or 3.5 x 6 inch specimens when compacted with a gyratory), except that the 16 hour curing time requirement and 72 to 96 hour storage period will be waived. Design tests shall use the same materials that are to be used in the production mix.

When a chemical additive is used, it shall be added to the asphalt cement prior to introduction into the mix. Any chemical additive or particular concentration of chemical additive found to be harmful to the asphalt material or which changes the viscosity of the original asphalt

cement more than 400 poises or the penetration more than -4 or +10 shall be changed to obtain compliance with these values.

- (i) Hydrated lime shall conform to the requirements of ASTM C977. Hydrated lime shall be added at a rate of not less than 1 percent by weight of the total dry aggregate.

A separate bin or tank and feeder system shall be provided to store and accurately proportion the lime into the aggregate in either dry or slurry form. The lime and aggregate shall be mixed by pugmill or other approved means to achieve a uniform lime coating of the aggregate prior to entering the drier. In the event lime is added in dry form, the aggregate shall contain at least 3 percent free moisture. The stockpiling of lime treated aggregate will not be permitted.

The feeder system shall be controlled by a proportioning device, which shall be accurate to within ± 10 percent of the specified amount. The proportioning device shall have a convenient and accurate means of calibration. A flow indicator or sensor shall be provided with the proportioning device and interlocked with the plant controls (aggregate feed or weigh system) such that production of the mixture will be maintained and, if there is a stoppage of the lime feed, interrupted.

The method of introducing and mixing the lime and aggregate shall be subject to approval by the COTR prior to beginning production.

- (j) Reclaimed Asphalt Pavement (RAP) material may be used as a component material of asphalt mixtures in conformance with the following:

1. Asphalt surface, intermediate, and base mixtures containing RAP shall use the PG grade of asphalt cement as indicated in Table II-14A.
2. The final asphalt mixture shall conform to the requirements for the type specified.
3. During the production process, RAP material shall not be allowed to contact open flame.
4. RAP material shall be handled, hauled and stored in a manner that will minimize contamination. Further, the material shall be stockpiled and used in such manner that variable asphalt contents and asphalt penetration values will not adversely affect the consistency of the mixture.
5. RAP shall be processed in such a manner as to ensure that the maximum top size introduced into the mix shall be 2 inches. The COTR may require smaller sized particles be introduced into the mix if the reclaimed particles are not broken down or uniformly distributed throughout the mixture during heating and mixing.

Sec. 02211.03—Job-Mix Formula.

The Contractor shall submit for the COTR's approval, a job-mix formula for each mixture to be supplied. The job-mix formula shall be within the design range specified. The job-mix formula shall establish a single percentage of aggregate passing each required sieve, a single percentage of asphalt material to be added to the aggregate, a temperature at which the mixture is to be produced and a temperature at which the mixture is to be compacted for SUPERPAVE testing according to the requirements of AASHTO R35. Each approved job-mix formula shall remain in effect, provided the results of tests performed on material currently being produced consistently meet the requirements of the job-mix for grading, asphalt content, temperature and SUPERPAVE compaction results.

- (a) SUPERPAVE mixes shall be designed and controlled according to the requirements of AASHTO R35. The contractor shall have available all of the equipment outlined in AASHTO TP-4 (Section 4-6) and a VDOT certified SUPERPAVE Level I Mix Design Technician. The SUPERPAVE gyratory compactor (SGC) shall be one from the VDOT approved list. The SUPERPAVE mixes shall conform to the criteria outlined in Table II-13 and Table II-14. Section 7.1.2 of AASHTO PP-2-99 shall be modified such that the compaction temperature is as specified in Section 02211.03 (d) 6 herein.

The mixture shall be designed and compacted at the N design gyrations specified in Table II -14. The N max requirement shall be verified as part of the design process by compacting a minimum of 2 specimens at the design asphalt content.

- (b) In conjunction with the submittal of a job-mix formula, the Contractor shall submit complete SUPERPAVE design test data, ignition furnace calibration data according to VTM-102 prepared by an approved testing laboratory and viscosity data or supplier temperature recommendations for the asphalt cement if different from Section 02211.03(d)6 herein..
- (c) Three trial blends for gradation shall be run at 1 asphalt content. No more than 1 of the trial blend gradations shall pass through the restricted zone defined in Table II-13A. An aggregate blend that was previously developed and approved as a job mix formula at a higher gyration level, may be used for subsequent year's mix designs which require a lower gyration level in lieu of developing three new trial blends.
- (d) The SUPERPAVE design test data shall include but not be limited to the following information:
1. Grading data for each aggregate component of 3 trial blends shall be submitted to the Authority. The data for the mixture will show percent passing for sieves 2", 1 1/2", 1", 3/4", 1/2", 3/8", No. 4, No. 8, No. 16, No. 30, No. 50, No. 100 and No. 200. The grading shall be reported to the nearest 1.0 percent except the No. 200 sieve shall be reported to nearest 0.1 percent.
 2. The test data shall include but not be limited to the percentage of each aggregate component as compared to the total aggregate in the asphalt mixture. The specific gravity and aggregate properties for coarse and fine aggregates defined in Sections 02211.02 (b) and (c), including flat and elongated properties, for each aggregate component or for the total aggregates used in the mixture shall be reported. Aggregate properties (except Sand Equivalent) shall be reported for RAP portions of a mixture. The aggregate specific gravity of RAP shall be the effective aggregate specific gravity calculated from the results of AASHTO T 209 and VTM 102.
 3. The aggregate grading in the asphalt mixture shall be determined by igniting or extracting the asphalt from a laboratory prepared sample. The laboratory sample shall be batched on the basis of component percentages as indicated in Section 02211.02 (d) 2 herein and at the proposed job-mix asphalt content. The aggregate shall be obtained in accordance with the requirements of VTM-102 or (VTM-36 when approved). Sieves noted in Section 02211.02 (d) shall be reported, beginning with the top size for that mix.

| <u>Property</u> | <u>Test</u> |
|-------------------------|---------------------------------|
| Asphalt content | VTM-102, (VTM-36 when approved) |
| Gradation | AASHTO T-30 |
| SUPERPAVE properties | AASHTO R35 |
| Asphalt cement material | AASHTO T316 or T-201 |

The Department will perform rut testing in accordance with the procedures detailed in VTM-110. If the results of the rut testing do not conform to the following requirements, the COTR reserves the right to require adjustments to the job-mix formula:

| Mix Designation | Maximum Rut Depth, mm |
|------------------------|------------------------------|
| A | 7.0 |
| D | 5.5 |
| E, (M), (S) | 3.5 |

After calibration of the gyratory compactor is completed, adjustments to the job-mix formula may be required by the COTR.

TABLE II-12A
Aggregate Properties

| TABLE II-12A | | | | | |
|---|--|--------------------------|------------------------------------|----------------------------------|------------|
| Aggregate Properties | | | | | |
| Mix Type | Coarse Aggregate Properties | | | Fine Aggregate Properties | |
| | Coarse Aggregate Angularity (CAA) | | | SE | FAA |
| | 1 fractured Face | 2 fractured Faces | F & E Percent by weight | | |
| SM-9.0A | 85% min. | 80% min. | 10% Max* | 40% min. | 40% min. |
| SM-9.0D | 85% min. | 80% min. | 10% Max* | 45% min. | 45% min. |
| SM-9.0E | 95% min. | 90% min. | 10% Max* | 45% min. | 45% min. |
| SM-9.5A | 85% min. | 80% min. | 10% Max* | 45% min. | 45% min. |
| SM-9.5D | 85% min. | 80% min. | 10% Max* | 45% min. | 45% min. |
| SM-9.5E | 95% min. | 90% min. | 10% Max* | 45% min. | 45% min. |
| SM-12.5A | 85% min. | 80% min. | 10% Max* | 45% min. | 45% min. |
| SM-12.5D | 85% min. | 80% min. | 10% Max* | 45% min. | 45% min. |
| SM-12.5E | 95% min. | 90% min. | 10% Max* | 45% min. | 45% min. |
| IM-19.0A | 85% min. | 80% min. | 10% Max* | 45% min. | 45% min. |
| IM-19.0D | 95% min. | 90% min. | 10% Max* | 45% min. | 45% min. |
| BM-25.0 | 80% min. | 75% min. | 10% Max* | 45% min. | 45% min. |
| BM-37.5 | 80% min. | 75% min. | 10% Max* | 45% min. | 45% min. |
| *10 percent measured at 5:1 on maximum to minimum dimension | | | | | |

TABLE II - 15
Asphalt Concrete Mixtures-Design Range
Percentage By Weight Passing Square Mesh Sieves (In)

| Mix Type | 2 | 1 1/2 | 1 | 3/4 | 1/2 | 3/8 | No. 4 | No. 8 | No. 30 | No. 50 | No. 200 |
|---------------|-----|--------|--------|--------|--------|--------|--------|-------|--------|--------|---------|
| SM-9.0 A,D,E | | | | | 100 | 90-100 | 90 max | 47-67 | | | 2-10 |
| SM-9.5 A,D,E | | | | | 100 | 90-100 | 90 max | 32-67 | | | 2-10 |
| SM-12.5 A,D,E | | | | 100 | 90-100 | 90 max | -- | 28-58 | | | 2-10 |
| IM-19.0 A,D | | | 100 | 90-100 | 90 max | -- | -- | 23-49 | | | 2-8 |
| BM-25.0 | | 100 | 90-100 | 90 max | -- | -- | -- | 19-45 | | | 1-7 |
| BM-37.5 | 100 | 90-100 | 90 max | -- | -- | -- | -- | 15-41 | | | 0-6 |
| C | | | | | 100 | 92-100 | 70-75 | 50-60 | 28-36 | 15-20 | 7-9 |

Legend: SM = Surface Mixture; IM = Intermediate Mixture; BM = Base Mixture; C = Curb Mixture

TABLE II-13A
Minimum And Maximum Boundaries Of Restricted Gradation
Minimum and Maximum Percent Passing
Nominal Maximum Aggregate Size

| Sieve Size | 3/8 | | 1/2 | | 3/4 | | 1 | | 1 1/2 | |
|------------|------|------|------|------|------|------|------|------|-------|------|
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| No. 4 | -- | -- | -- | -- | -- | -- | 39.5 | 39.5 | 34.7 | 34.7 |
| No. 8 | 47.2 | 47.2 | 39.1 | 39.1 | 34.6 | 34.6 | 26.8 | 30.8 | 23.3 | 27.3 |
| No. 16 | 31.6 | 37.6 | 25.6 | 31.6 | 22.3 | 28.3 | 18.1 | 24.1 | 15.5 | 21.5 |
| No. 30 | 23.5 | 27.5 | 19.1 | 23.1 | 16.7 | 20.7 | 13.6 | 17.6 | 11.7 | 15.7 |
| No. 50 | 18.7 | 18.7 | 15.5 | 15.5 | 13.7 | 13.7 | 11.4 | 11.4 | 10.0 | 10.0 |

TABLE II-14 MIX DESIGN CRITERIA is replaced with the following:

TABLE II-14
Mix Design Criteria

| Mix Type | VTM (%) | VFA | VFA (%) | Min. | Fines/Asphalt | No. of Gyration | | | Density |
|---------------------------------|------------------------|---------------|-----------------------|------------|-------------------|-----------------|--------------|----------|------------------------|
| | Production (Note 1) | (%) Design | Production (Note2) | VMA (%) | Ratio (Note 3) | N Design | N Initial | N Max | (%) at N Initial |
| SM-9.0A ^{Notes 1,2,3} | 2.0-5.0 | 75-80 | 70-85 | 16 | 0.6-1.3 | 65 | 7 | 100 | < 90.5 |
| SM-9.0D ^{Notes 1,2,3} | 2.0-5.0 | 75-80 | 70-85 | 16 | 0.6-1.3 | 65 | 7 | 100 | < 89.0 |
| SM-9.0E ^{Notes 1,2,3} | 2.0-5.0 | 75-80 | 70-85 | 16 | 0.6-1.3 | 65 | 7 | 100 | < 89.0 |
| SM-9.5A ^{Notes 1,2,3} | 2.0-5.0 | 73-79 | 68-84 | 15 | 0.6-1.2 | 65 | 7 | 100 | < 90.5 |
| SM-9.5D ^{Notes 1,2,3} | 2.0-5.0 | 73-79 | 68-84 | 15 | 0.6-1.2 | 65 | 7 | 100 | < 89.0 |
| SM-9.5E ^{Notes 1,2,3} | 2.0-5.0 | 73-79 | 68-84 | 15 | 0.6-1.2 | 65 | 7 | 100 | < 89.0 |
| SM-12.5A ^{Notes 1,2,3} | 2.0-5.0 | 70-78 | 65-83 | 14 | 0.6-1.2 | 65 | 7 | 100 | < 90.5 |
| SM-12.5D ^{Notes 1,2,3} | 2.0-5.0 | 70-78 | 65-83 | 14 | 0.6-1.2 | 65 | 7 | 100 | < 89.0 |
| SM-12.5E ^{Notes 1,2,3} | 2.0-5.0 | 70-78 | 65-83 | 14 | 0.6-1.2 | 65 | 7 | 100 | < 89.0 |
| SM-19.0A ^{Notes 1,2,3} | 2.0-5.0 | 69-76 | 64-81 | 13 | 0.6-1.2 | 65 | 7 | 100 | < 90.5 |
| SM-19.0D ^{Notes 1,2,3} | 2.0-5.0 | 69-76 | 64-81 | 13 | 0.6-1.2 | 65 | 7 | 100 | < 89.0 |
| SM-25.0A ^{Notes 1,2,3} | 1.0-4.0 | 67-87 | 67-92 | 12 | 0.6-1.3 | 65 | 7 | 100 | < 89.0 |
| SM-25.0D ^{Notes 1,2,3} | 1.0-4.0 | 67-87 | 67-92 | 12 | 0.6-1.3 | 65 | 7 | 100 | < 89.0 |

¹SM = Surface Mixture; IM = Intermediate Mixture; BM = Base Mixture.

Note 1: Asphalt content should be selected at 4.0 % Air Voids,

Note 2: During production of an approved job mix, the VFA shall be controlled within these limits.

Note 3: Fines-asphalt ratio is based on effective asphalt content.

Note 4: Base mix shall be designed at 2.5% air voids. BM-25.0 A shall have a minimum asphalt content of 4.4% unless otherwise approved by the Engineer. BM-25.0D shall have a minimum asphalt content of 4.6% unless otherwise approved by the Engineer.

4. The following volumetric properties of the compacted mixture calculated on the basis of the mixture's maximum specific gravity determined by AASHTO T-209. The mixture must be aged in accordance with AASHTO PP-2-99 and the bulk specific gravity of the specimens determined by AASHTO T-166, Method A for each asphalt content tested. Properties shall be determined and is reported in accordance with the requirements of AASHTO PP28-99.
 - a. Voids in total mix (VTM)
 - b. Voids in mineral aggregate (VMA)
 - c. Voids filled with Asphalt (VFA)
 - d. Fines/Asphalt ratio (F/A)
 5. The value of the maximum specific gravity of the asphalt mixture used in 02211.03 (c) 4 shall be reported to 3 decimal places.
 6. The mixing and compaction temperature for testing shall be as follows:

For mix designation A and all Base mixes, the mix temperature shall be 300°F to 310°F and the compaction temperature shall be 285°F to 290°F.

For mix designation D, the mix temperature shall be 310°F to 320°F and the compaction temperature shall be 295°F to 300°F.

In cases involving PG 76-22 or modified binders, the temperatures shall be based on documented supplier's recommendations.
 7. Field correction factor. The field correction factor is determined by subtracting the bulk specific gravity of the aggregate from the effective specific gravity of the aggregate at the design asphalt content.
- (e) The SUPERPAVE design test data shall be plotted on graphs provided by the software of the test equipment manufacturer and shall show that the proposed job-mix formula conforms to the requirements of the mix type.
- (f) A determination will be made that any asphalt concrete mixture being produced conforms to the job-mix formula approved by the Authority. The Authority will test the mixture using samples removed from production. The following tests will be run to determine the properties listed:
- | | | |
|----|-------------------------|--------------------------------|
| 1. | Asphalt Content | VTM-102 (VTM-36 when approved) |
| 2. | Gradation | AASHTO T-30 |
| 3. | SUPERPAVE Properties | AASHTO PP28-99 |
| 4. | Asphalt Cement Material | AASHTO TP-48 or T-201 |

At the discretion of the COTR, the Authority in accordance with VTM-110 will perform rut testing. If the results of the rut testing do not conform to the table below, the COTR reserves the right to require adjustments to the job-mix formula.

| Mix Designation | Maximum Rut Depth, mm |
|-----------------|-----------------------|
| A | 7.0 |
| D | 5.5 |
| E, (M), (S) | 3.5 |

In the event the Authority determines that the mixture being produced does not conform to the approved job mix formula and volumetric properties in Table II-14 based on Authority or Contractor's test results, the Contractor shall immediately make corrections to bring the mixture into conformance with the approved job-mix formula or cease paving with that mixture.

Subsequent paving operations, using either a revised or other job-mix formula which has not been verified as described herein, shall be limited to a test run of 100 to 300 tons of mixture if such material is to be placed in Authority work. No further paving for the Authority using that specific mixture is to occur until the acceptability of the mixture being produced has been verified using the 100 to 300 ton constraint.

Asphalt concrete mixtures used in surface, intermediate, and base courses shall conform to the following requirements when tested in accordance with the requirements of AASHTO PP28-99:

TABLE 11-14A

**Recommended Performance Grade of Asphalt
Percentage RAP in Mix**

| Mix Type | %RAP \leq 20.0% | 20.0% $<$ %RAP \leq 20.0% | 20.0% $<$ %RAP \leq 35% |
|----------------------------|-------------------|--------------------------------|---------------------------|
| SM-9.0A, SM-9.5A, SM-12.5A | PG 64-22 | PG 64-22 | |
| SM-9.0D, SM-9.5D, SM-12.5D | PG 70-22 | PG 64-22 | |
| IM-19.0A | PG 64-22 | PG 64-22 | |
| IM-19.0D | PG-70-22 | PG 64-22 | |
| BM-25.0A | PG 64-22 | | PG 64-22 |
| BM-25.0D | PG 70-22 | | PG 64-22 |

*BM-25.0 and BM-37.5 mixes using more than 25 percent RAP shall use a PG 58-22.

Base mixes shall have a minimum asphalt content of 4.0 percent determined by SUPERPAVE design as specified herein.

Based on rut testing performed by the Authority and/or field performance of the job -mix, the COTR reserves the right to require adjustments to the job-mix formula. Based upon a plot of aggregate grading, which indicates an aggregate grading passes through the restricted zone

established by Table II-14A, the COTR reserves the right to require rut testing of the job-mix. Based on the rut testing, the COTR reserves the right to require adjustments in the job-mix formula.

Sec. 02211.04—Asphalt Concrete Mixtures.

Asphalt concrete mixtures shall conform to the requirements of Table II-14 and the following:

- (a) **Types SM-9.0A, SM-9.0D, SM-9.0E, SM-9.5A, SM-9.5D, SM-9.5E, SM-12.5A, SM-12.5D, and SM-12.5E** asphalt concrete shall consist of crushed stone or crushed gravel and fine aggregate, slag or a combination thereof combined with asphalt cement.

NOTE: For all surface mixes, except where otherwise noted, no more than 5 percent of the aggregate retained on the No. 4 sieve and no more than 20 percent of the total aggregate may be polish susceptible.

- (b) **Types IM-19.0A and IM-19.0D** asphalt concrete shall consist of crushed stone, crushed gravel and fine aggregate, stone screenings or a combination thereof combined with asphalt cement.

NOTE: At the discretion of the COTR, an intermediate mix may be designated as either a SM-19.0A or SM-19.0D. When designated as such, no more than 5 percent of the aggregate retained on the No. 4 sieve may be polish susceptible. All material passing the No. 4 sieve may be polish susceptible.

- (c) **Types BM-25.0 and BM-37.5** asphalt concrete shall consist of crushed stone, crushed gravel and fine aggregate, stone screenings or a combination thereof combined with asphalt cement.

- (d) **Type C (Curb Mix)** Asphalt Concrete shall consist of a blend of No. 78 or No. 8 crushed aggregate, No. 10 crushed aggregate, fine aggregate, mineral filler and a stabilizing additive from the Authority's approved list; combined with 6.0 – 9.0 percent of PG 64-22. This mix does not require a volumetric mix design or volumetric testing under the SUPERPAVE system.

- (e) **Asphalt mixtures Type SM-9.5, SM-12.5, IM-19.0, and BM-25.0** may be designated (M) for modified, (S) for stabilized or (M) or (S) for Contractor's option. Asphalt mixtures with the E designation may be modified, but shall not be stabilized.

1. Type (M) and E asphalt mixtures shall consist of mixes incorporating a neat asphalt material with polymer modification meeting the requirements of a PG 76-22 and have a Rolling Thin Film Oven Test residue elastic recovery at 77° F of a minimum 70 percent when tested in accordance with ASTM D 6084 procedure A. Type (M) and E asphalt mixtures shall not be permitted to exceed 15 percent reclaimed asphalt pavement material.

2. Type (S) asphalt mixtures shall consist of mixes incorporating a stabilizing additive from the VDOT's approved list found in the Materials Division's Manual of Instructions. These mixes shall be designated with a (S) following the standard mix designation. The minimum required additive shall be as specified on the approved list.

Sec. 02211.05—Testing.

The Contractor shall provide the quality control and assurance necessary for the COTR to determine conformance with the required grading, asphalt content and temperature properties for asphalt concrete.

The Contractor shall maintain all records and test results associated with the material production and shall maintain appropriate current quality control charts. All test results and control charts shall be available for review by the COTR.

The Contractor shall execute a quality control plan of process inspections and tests, including the determination of SUPERPAVE properties. The results of the SUPERPAVE tests shall be used, along with the results of other quality control efforts, to control the quality of the mixture being produced.

The Contractor shall perform at least one field SUPERPAVE test per day per mix or per 1000 tons per mix if more than 1000 tons of a mix is produced per day (aging as described in PP-2-99 shall not be performed). In the event less than 300 tons of asphalt mixture is produced under a single job mix formula in a day, field SUPERPAVE testing will not be required. This tonnage shall be added to subsequent production. When the accumulated tonnage exceeds 300 tons, minimum testing frequency shall apply. Field SUPERPAVE test results shall be plotted and displayed in control chart form in the plant immediately following the completion of each individual test. The tests shall determine asphalt content, VTM, VMA, VFA and F/A in percent to the nearest 0.1 percent.

Field SUPERPAVE tests shall be performed to N design gyrations as specified in Table II-14. At the COTR's discretion, the N max requirement may be checked.

Sec. 02211.06—Tests.

The Authority may sample materials entering into the composition of the asphalt concrete, the mixture or the completed pavement. The Contractor shall cooperate with the COTR in obtaining these samples. When samples are obtained from the pavement, the resulting voids shall be filled and refinished by the Contractor without additional compensation.

When asphalt cement is extracted and recovered in accordance with AASHTO T170, the recovered asphalt cement shall have the following penetration and ductility at 77°F:

| Mix Type | Recovered Penetration | Recovered Penetration | Ductility at 77°F |
|----------------------|-----------------------|-----------------------|-------------------|
| | RAP% ≤ 20.0% | RAP% > 20.0% | |
| SM-9.0A, 9.5A, 12.5A | min 35 | min 35 | min 40 cm |
| SM-9.0D, 9.5D, 12.5D | min 25 | min 25 | min 40 cm |
| IM-19.0A | min 35 | min 35 | min 40 cm |
| IM-19.0D | min 25 | min 25 | min 40 cm |
| BM-25.0A, BM-25.0D | min 35 | min 35 | min 40 cm |

NOTE: Recovered Penetration and Ductility shall not be performed on SM-9.5E, 12.5E, and all (M) and (S) mixes.

Abson recovery samples that fail recovered penetration or ductility shall be PG graded according to AASHTO M 320-05. If the samples meet the required grade specified in Section 2211.01, they shall be deemed acceptable.

When the Authority performs PG grading on a Contractor's liquid asphalt storage tank, the COTR will notify the Asphalt Concrete Producer and Binder Supplier if tests indicate that the binder properties of the asphalt material differs from the approved job-mix. It will be the responsibility of the Asphalt Concrete Producer and Binder Supplier to determine corrective action with the approval of the COTR.

Sec. 02211.07—Plant Inspection.

The preparation of asphalt concrete mixtures will be accepted under a quality assurance plan. The Contractor shall provide a laboratory testing as specified in Section 01400 of the Specifications.

In addition, the Contractor shall have all laboratory scales and gyratory compactors calibrated once a year by an independent source. The Contractor shall maintain the calibration records for 3 years.

Sec. 02211.08—Acceptance.

Sampling and testing for the determination of grading, asphalt cement content and temperature shall be performed by the Contractor. The Contractor shall provide copies of such test results to the COTR. In the event the Contractor's test results indicate that the mixture conforms to the gradation, asphalt cement content and mix temperature requirements of the Specifications, the mixture will be acceptable for these properties; however, nothing herein shall be construed as waiving the requirements of Sections 01400. "Quality Requirements", 02200.02 "General " and 02200.03 of the Specifications or relieving the Contractor of the obligation to furnish and install a finished functional product which conforms to the requirements of the Contract.

Acceptance for gradation and asphalt cement content will be based upon a mean of the results of four tests performed on samples taken in a stratified random manner from each 1000 ton lot (2000 ton lots may be used when the normal daily production of the source from which the material is being obtained is in excess of 2000 tons). Unless otherwise approved, samples shall be obtained from the approximate center of randomly selected quadrants of truckloads of material. Any statistically acceptable method of randomization may be used to determine the time and location of the stratified random sample to be taken; however, the Authority shall be advised of the method to be used prior to beginning production.

A lot will be considered to be acceptable for gradation and asphalt content if the mean of the test results obtained is within the tolerance allowed from the job-mix formula, as shown in Table II-15.

The temperature of the mixture at the plant shall be controlled to provide load-to-load uniformity during changing weather conditions and surface temperatures. The maximum temperature of mix designations A and D, and base mixes, shall not exceed 350°F unless otherwise directed by the COTR. The maximum temperature as recommended by the supplier shall not be exceeded for an E, (M), or (S) designated mix.

In the event the job-mix formula is modified within a lot, the mean test results of the samples taken will be compared to the applicable process tolerance shown in Table II-15.

Asphalt content will be measured as extractable asphalt or weight after ignition.

Field SUPERPAVE tests will be performed by the Authority in accordance with the requirements of AASHTO PP28-99 during the production of the approved job-mixes designed by the SUPERPAVE method. Aging, as described in PP-2-99, shall not be performed. Should any Field SUPERPAVE test fail to meet the specified limits contained in Table II-14, the Authority may require that production be stopped until necessary corrective action is taken by the Contractor.

The COTR will investigate and determine the acceptability of material placed and represented by failing Field SUPERPAVE test results

Should visual examination by the COTR reveal that the material in any load or portion of the paved roadway is obviously contaminated or segregated, that load or portion of the paved roadway will be rejected without additional sampling or testing of the lot. In the event it is necessary to determine the gradation or asphalt content of the material in any load or portion of the paved roadway, samples will be taken, tested, and the results compared to the requirements of the approved job-mix formula. The results obtained in the testing will apply only to the material in question.

Sec. 0211.09—Adjustment System.

In the event a lot of material does not conform to the acceptance requirements of Section 02211.08, adjustment points will be determined as follows:

Adjustment Points for Each 1% that the Gradation is Outside the Process Tolerance Permitted in Table II-15

| Sieve (Inches) | (Applied in 0.1 Increments) |
|-------------------|-----------------------------|
| 1 1/2 | 1 |
| 1 | 1 |
| 3/4 | 1 |
| 1/2 | 1 |
| 3/8 | 1 |
| No. 4 | 1 |
| No. 8 | 1 |
| No. 30 | 2 |
| No. 50 | 2 |
| No. 200 | 3 |

One adjustment will be applied for each 0.1 percent that the material is out of the process tolerance for asphalt content.

In the event the total adjustment for a lot is greater than 25 points, the failing material shall be removed from the road. In the event the total adjustment is 25 points or less and the Contractor does not elect to remove and replace the material, the unit price for the material will be reduced 1 percent of the unit price bid for each adjustment point. The adjustment will be applied to the tonnage represented by the sample or samples. In the event adjustment points are applied against 2 successive lots, plant adjustment shall be made prior to continuing production.

The Contractor shall control the variability of his product in order to furnish a uniform mix. When the quantity of any one-type material furnished a project exceeds 4000 tons, the variability of the total quantity furnished will be determined on the basis of the standard deviation for each sieve size and the asphalt content. In the event the standard deviation is within the ranges shown in Table II-16, the unit bid price for the material will be adjusted as indicated herein. Adjustments for standard deviation computations will not be made on more than two job mixes for the same type material.

TABLE II-15
Process Tolerance

Tolerance on Each Laboratory Sieve and Asphalt Content - Percent Plus and Minus

| Number Tests | Top Size | 1 1/2 in | 1 in | 3/4 in | 1/2 in | 3/8 in | No. 4 | No. 8 | No. 30 | No. 50 | No. 200 | A.C. |
|--------------|----------|----------|------|--------|--------|--------|-------|-------|--------|--------|---------|------|
| 1 | 0.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 6.0 | 5.0 | 2.0 | .60 |
| 2 | 0.0 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 4.3 | 3.6 | 1.4 | 0.43 |
| 3 | 0.0 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 3.3 | 2.8 | 1.1 | 0.33 |
| 4 | 0.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 2.5 | 1.0 | 0.30 |
| 8 | 0.0 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.1 | 1.8 | 0.7 | 0.21 |

Note: The Top Size is defined as the sieve which has 100% passing as defined in Table II-13. The Top Size tolerance for SM-9.0 and SM-9.5 mixes shall be as follows;

| Number Tests | Top Size |
|--------------|----------|
| 1 | 2.0 |
| 2 | 1.4 |
| 3 | 1.1 |
| 4 | 1.0 |
| 8 | 0.7 |

The unit bid price will be reduced by 0.5 percent for each adjustment point applied for standard deviation.

The COTR will determine the disposition of material having standard deviations larger than those shown in Table II-16.

TABLE II-16
STANDARD DEVIATION

| Sieve Size and A.C. | Standard Deviation 1 Adjustment Point For Each Sieve Size & A.C. | 2 Adjustment Points For Each Sieve Size and A.C. | 3 Adjustment Points For Each Sieve Size and A.C. |
|---------------------|--|--|--|
| ½ in. | 3.8 - 4.7 | 4.8 - 5.7 | 5.8 - 6.7 |
| 3/8 in. | 3.8 - 4.7 | 4.8 - 5.7 | 5.8 - 6.7 |
| No. 4 | 3.8 - 4.7 | 4.8 - 5.7 | 5.8 - 6.7 |
| No. 8 | 3.0 - 3.9 | 4.0 - 4.9 | 5.0 - 5.9 |
| No. 30 | 2.2 - 3.1 | 3.2 - 4.1 | 4.2 - 5.1 |
| No. 50 | 1.5 - 2.4 | 2.5 - 3.4 | 3.5 - 4.4 |
| No. 200 | 1.1 - 2.0 | 2.1 - 3.0 | 3.1 - 4.0 |
| A. C. | 0.27 - 0.36 | 0.37 - 0.46 | 0.47 - 0.56 |

Sec. 022211.10—Referee System.

- (a) In the event the test results obtained from one of the four samples taken to evaluate a particular lot appear to be questionable, the Contractor may request in writing that the results of the questionable sample be disregarded; whereupon, the Contractor shall have either an AASHTO accredited lab or Authority lab perform tests on five additional samples taken from randomly selected locations in the roadway where the lot was placed. In the event the COTR determines that one of the four tests results appears to be questionable, the Authority will perform tests on five additional samples taken from randomly selected locations in the roadway where the lot was placed. The test results of the three original (unquestioned) samples will be averaged with test results of the five road samples and the mean of the test values obtained for the eight samples will be compared to the requirements for the mean of eight tests as shown in Table II-15.
- (b) In the event the Contractor questions the mean of the four original test results obtained for a particular lot, the Contractor may request in writing approval to have either an AASHTO accredited lab or Authority lab perform additional testing of that lot. In the event the COTR determines that the mean of the four original test results are questionable, the Authority will perform additional testing of that lot. The test results of the original four samples will be averaged with the test results of the four additional samples taken from randomly selected locations in the roadway where the lot was placed and the mean of test values obtained for the eight samples will be compared to the requirements for the mean result of eight tests as shown in Table II-15.

If the Contractor requests additional tests, as described in Paragraph (a) or (b) herein, the Contractor shall sample and have either an AASHTO accredited lab or Authority lab test the material in accordance with Authority approved procedures. The COTR reserves the right to observe the sampling and testing.

In the event the mean of the test values obtained for the eight samples conforms to the requirements for the mean results of eight tests, the material will be considered acceptable. In the event the mean of the test values obtained for the eight samples does not conform to the requirements for the mean result of eight tests, the lot will be adjusted in accordance with the adjustment rate specified in Section 02211.09.

Samples of the size shown herein shall be saw cut by the Contractor, without the use of liquids, for testing.

| Application Rate | Minimum Sample Size |
|-------------------------|----------------------------|
| 125 lbs/s.y. | 8 by 8 inches |
| 150 lbs./ s.y. | 7 by 7 inches |
| 200 lbs/s.y. | 6 by 6 inches |
| 300 lbs./s.y. | 5 by 5 inches |

Sec. 02211.11—Handling and Storing Aggregates.

Aggregates shall be handled, hauled and stored in a manner which will minimize segregation and avoid contamination. Aggregates shall be stockpiled in the vicinity of the plant and on ground that is denuded of vegetation, hard, well drained or otherwise prepared to protect the aggregate from contamination. Placing aggregate directly from the crusher bins into the cold feed may be permitted, provided the material is consistent in gradation. When different size aggregates are stockpiled, the stockpiles shall be separated to prevent commingling of the aggregates.

Sec. 02211.12—Asphalt Concrete Mixing Plant.

Plants used for the preparation of asphalt concrete mixtures shall conform to the following requirements:

- (a) **Certification for Plant Operation and Sampling** – There shall be a certified asphalt plant technician for sampling material at the plant.
- (b) **Plant Scales** - Scales shall be approved in accordance with the requirements of Section 01271 “Measurement and Payment” of the Specifications.
- (c) **Drier** - The plant shall include a drier or driers which continuously agitate the aggregate during the heating and drying process. The aggregate shall be dried to a point at which the moisture content of the completed mixture does not exceed 1 percent as determined from samples taken at the point of discharge from the mixing operation.
- (d) **Feeder for Drier** - The plant shall be equipped with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and uniform temperature will be obtained. Where different size aggregates are required to meet grading

specifications, they must be proportioned by feeding into the cold elevator through a multiple compartment feeder bin (one bin for each size used) equipped with positive action gates that can be securely locked to maintain desired proportioning.

- (e) **Bins** - When bins are used, adequate and convenient facilities shall be provided to make possible the sampling of representative aggregate material for each bin. Each compartment shall be provided with an overflow pipe of such size and at such location to prevent contamination of the aggregate in adjacent compartments and shall be provided with individual outlet gates which, when closed, will allow no leakage.
- (f) **Thermometric Equipment** - The plant shall be equipped with an thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate or the completed mix if the drier drum mixing plant is used.

A thermometric device shall be fixed in the asphalt feed line at a suitable location near the charging valve at the mixer unit.

All thermometric devices shall be maintained in good working condition and shall be subject to checking against the laboratory thermometer. Any instruments that do not operate or register properly shall be removed and repaired or replaced.

- (g) **Pollution Control** shall conform to the requirements of Section 02935 "Stormwater Pollution Prevention" of the Specifications.
- (h) **Equipment for Preparation of Asphalt Material** - Tanks for the storage of asphalt material shall be equipped with a heating system capable of heating and holding the material at the required temperatures. A separate storage tank or a storage tank having separate compartments shall be available for each grade of asphalt cement being used. The heating system shall be designed to heat the contents of the tank by means of steam, electricity or other approved means so that no flame is in contact with the heating surface of the tank. The circulating system for the asphalt material shall be designed to assure proper and continuous circulation during the operating period and to minimize oxidation. All pipelines shall be steam jacketed or insulated to prevent undue loss of heat. Storage facilities for asphalt material shall be sufficient for at least one day's operation or an equivalent means of supply shall be provided which will insure continuous operation. Provisions shall be made for measuring and sampling storage tanks. When asphalt material is proportioned by volume, the temperature of the asphalt material in storage shall be uniformly maintained ($\pm 20^{\circ}$ F) during operation of the plant by means of an automatic temperature control device.
- (i) **Asphalt Control** -- Asphalt material shall be accurately proportioned by volume or weight. When volumetric methods are used, measurements shall be made by means of meters or pumps, calibrated for accuracy. The section of the asphalt line between the charging valve and the spray bar shall be provided with an outlet valve for checking the meter.

When proportioned by weight, the asphalt material shall be weighed on approved scales. Dial scales shall have a capacity of not more than 15 percent of the capacity of the mixer. The value of the minimum graduation shall not be greater than 2 pounds.

Except when drier-drum mixing plant is used, the asphalt material bucket, its valves and spray bar shall be steam jacketed or heated by other approved means. The bucket shall have a capacity of at least 115 percent of the weight of the asphalt material required in any mixture and shall be supported by fulcrums.

The asphalt shall be delivered to the mixer in multiple uniform streams for the full width of the mixer.

- (j) **Proportioning Aggregates** - Mineral filler and any bag house fines the Contractor uses shall be metered or introduced by means of an approved device for uniform proportioning by weight or by volume.

The weigh hopper shall be of sufficient size to hold the maximum required weight of aggregate for one batch without hand raking or running over. Sufficient clearance between the weigh hopper and supporting devices shall be provided to prevent accumulation of foreign materials.

The discharge gate of the weigh hopper shall be situated in such a manner that the aggregates will not segregate when dumped into the mixer. Gates on the bins and weigh hopper shall be constructed to prevent leakage when closed.

- (k) **Drum Mixer** - The aggregate shall be proportioned by a positive weight control at the cold aggregate feed by use of a belt scale which will automatically regulate the supply of material being fed and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions.
- (l) **Batch Mixer** - The batch mixer shall be of a twin pugmill or other approved type, steam jacketed or heated by other approved means and capable of producing uniform mixtures within the specified tolerances. It shall be equipped with a sufficient number of paddles or blades, operated at such speeds as to produce a properly and uniformly mixed batch. The number and arrangement of the mixer paddles shall be subject to the approval of the COTR. Worn or defective blades shall not be used in mixing operations.

The mixer shall be provided with an approved time lock which will lock the discharge gate after the aggregates and asphalt have been placed in mixer and will not release the gate until the specified time has elapsed.

Batch type mixing plants used to produce asphalt concrete shall be equipped with approved automatic proportioning devices. Such devices shall include equipment for accurately proportioning batches of the various components of the mixture by weight or volume in the proper sequence and for controlling the sequence and timing of mixing operations. The automated system shall be designed to interrupt and stop the batching operation at any time batch quantities are not satisfied for each of the materials. A means shall be provided for observing the weight of each material during the batching operation.

The aggregate may be proportioned by cold feed controls in lieu of plant screens provided the cold aggregate feed conforms to the requirements specified in Section 02211.12(j). Should the automatic proportioning devices become inoperative, the plant may be allowed to batch and mix asphalt materials for a period of not more than 48 hours from the time the breakdown occurs provided alternate proportioning facilities are approved by the COTR. Written

permission of the COTR will be required for operation without automatic proportioning facilities for periods longer than 48 hours.

- (m) **Continuous Mixing Plant** - Continuous mixing plant shall include a means for accurately proportioning each size of aggregate either by weighing or volumetric measurement. When gradation control is by volume, the unit shall include a feeder mounted under the compartment bins. Each bin shall have an accurately controlled individual gate to form an orifice for volumetrically measuring the material drawn from each respective bin compartment. The orifice shall be rectangular, with one dimension adjustable by positive mechanical means and shall be provided with a lock. Indicators shall be provided to show the individual gate opening in inches. The plant shall be equipped with a satisfactory revolution counter.

The plant shall include a means for calibrating gate openings by weight. The materials fed out of the bins through individual orifices shall be bypassed to a suitable test box, with each component material confined in a separate section. The plant shall be equipped to conveniently handle test samples weighing up to 200 pounds per bin and accurate platform scales shall be provided for this purpose. Positive interlocking control shall be provided between the flow of aggregate from the bins and the flow of asphalt material from the meter or other proportioning device. This shall be accomplished by approved interlocking devices or other approved positive means.

Accurate control of the asphalt material shall be obtained by weighing, metering or volumetric measurement.

The aggregate may be proportioned by cold feed controls in lieu of plant screens provided the cold aggregate feed conforming to the requirements specified in Section 02211.12(j). The plant shall include a continuous mixer of an approved type, which is steam jacketed or heated by other approved means. The paddles shall be of any adjustable type for angular position on the shafts and reversible to retard the flow of the mixture.

There shall be interlock cutoff circuits to interrupt and to stop the proportioning and mixing operations when the aggregate level in the plant or the asphalt material in storage fall below that necessary to produce the specified mixture.

- (n) **Trucks, Truck Scales, and Automatic Printer System** shall conform to the requirements of Section 01271 “ Measurement and Payment” of the Specifications.

Sec. 02211.13—Preparation of Mixture.

The asphalt and aggregate shall be introduced into the mixer at a temperature that will produce a mixture within the requirements of the job-mix formula.

After the required amounts of aggregate and asphalt material have been introduced into the mixer, the materials shall be mixed until a uniform coating of asphalt and a thorough distribution of the aggregate throughout the mixture is secured within the requirements of the Ross Count procedure described in AASHTO T195. Wet mixing time, based on the procedures of AASHTO T195, shall be determined by the Contractor at the beginning of production and approved by the COTR for each individual plant or mixer and for each type of aggregate used; however, in no case shall the wet mixing time be less than 20 seconds. The wet mixing time is the interval of time between the start of introduction of the asphalt material into the mixer and the opening of

the discharge gate. A wet mixing time which will result in fully coating a minimum of 95 percent of the coarse particles, based on the average of the 3 samples and provided that none of the 3 samples result in fully coating less than 92 percent of the coarse particles, shall be the minimum wet mixing time requirement. A dry mixing time of up to 15 seconds may be required by the COTR to accomplish the degree of aggregate distribution necessary to obtain complete and uniform coating of the aggregate with asphalt.

Sec. 02211.14—Storage System.

In the event the Contractor elects to use a storage system, the system shall be capable of conveying the mix from the plant to the storage bins and storing the mix without a loss in temperature, segregation or oxidation of the mix. Storage time shall be limited by the ability of the bins to maintain the mix within the quality requirements specified herein with a maximum time limit not to exceed 10 days. Material may be stored in bins for no more than 24 hours without an approved heating system.

The conveyor system may be a continuous or skip bucket type. Continuous type conveyors shall be enclosed so that the mix temperature is maintained.

The storage bins shall be designed in such a manner as to prevent segregation of the mix during discharge from the conveyor into the bins and shall be equipped with discharge gates that will not cause segregation of the mix while loading the mix into the trucks.

Approval for the use of storage bins may be withdrawn by the COTR in the event there is an excessive amount of heat loss, segregation or oxidation of the mix.

Sec. 02211.15—Initial Production.

At the start of production of a mix not previously used on a state roadway, the Contractor shall be placed on limited production at an approved site (may be project site) so the COTR can examine the mixing plant process control, placement procedures, surface appearance, compaction patterns and correlation of the nuclear density device. The material placed will be at the specified application rate and shall be paid for at the contract unit price for the specified mix type. The COTR will determine the disposition of material that was not successfully produced and/or placed due to negligence in planning, production or placement by the Contractor.

END OF SECTION 02211

SECTION 02212 - JOINT MATERIALS**Sec. 02212.01 Description—**

These specifications cover resilient products made from various materials that are designed to accommodate the movement of rigid structures, such as component parts of hydraulic cement concrete, and seal the joint from intrusion of water or incompressible.

Sec. 02212.02 Hot-Poured Joint Sealers--

- (a) **Asphalt Sealer** shall conform to the requirements of FS SS-S-1401 or AASHTO M173.

Hot-poured asphalt joint sealer shall be used only for longitudinal joints or crack sealing, unless otherwise specified.

- (b) **Elastomeric-Type Joint Sealer** shall conform to the requirements of ASTM D3406 and shall be used for longitudinal joints only.

Heating of the joint sealer material shall be in accordance with the manufacturer's recommendation.

Sec. 02212.03 Silicone Sealer shall be furnished in a one- or two-part formulation. The sealant shall be compatible with the surface to which it is applied. Acid-cure sealants are not acceptable for use on hydraulic cement concrete. Bond breakers shall be chemically inert and resistant to petroleum products, solvents, and primers.

Silicone sealants will be identified in the following manner:

1. **Class A:** A low-modulus non-sag silicone for use in sealing horizontal and vertical joints in hydraulic concrete pavements and structures. Tooling is required.
2. **Class B:** A very-low-modulus self-leveling silicone used to seal horizontal joints in hydraulic cement concrete pavements and structures. Tooling is not normally required.
3. **Class C:** An ultra-low-modulus self-leveling silicone used to seal horizontal joints in hydraulic cement concrete pavements and structures. It can also be used to seal the joints between hydraulic cement concrete pavement and asphaltic concrete shoulders. Tooling is not normally required.
4. **Class D:** An ultra-low-modulus self-leveling rapid-curing two-part silicone used to seal expansion joints on bridge decks. It can also be used to seal joints subject to dynamic movements where rapid curing is necessary. Tooling is not normally required.

Silicone sealants shall conform to the following physical requirements:

| Properties | Test Method | Sealant Class | | | |
|---|-----------------------------------|--|---------------|---------------|---------------|
| | | A | B | C | D |
| Tensile stress at 150% strain (max. psi) (Note 1) | ASTM C1135 | 45 | 40 | 15 | 25 |
| Durometer hardness, Shore (0° and 77°□} 3°F) (Note 1) | ASTM D2240 | “A” 10–25 | “00” 40–80 | “00” 20–80 | “00” 40–80 |
| Bond to concrete mortar (min. psi) (Notes 1 and 3) | VTM-90 | 50 | 40 | 35 | 35 |
| Tack-free time (skin-over) (max. min) (Note 2) | VTM-90 (Note 4) | 180 | 180 | 180 | 30 |
| Extrusion rate (min. g/min) | VTM-90 | 75 | 90 | 100 | 200 |
| Non-volatile (min. %) specific gravity | VTM-90 ASTM D792 (Method A) | 90 1.1–1.5 | 90 1.1–1.5 | 90 1.1–1.5 | 90 1.2–1.5 |
| Shelf life (from date of shipment) | | 6 mo | 6 mo | 6 mo | 6 mo |
| Movement capability and adhesion (Note 1) | VTM-90 | No adhesive or cohesive failure after 10 cycles at 0°F | | | |
| Ozone and UV resistance (Note 1) | ASTM C-793–75 | No chalking, cracking, or bond loss after 5,000 hr | | | |

Note 1: The cure time for these specimens shall be 21 days for Class A and 28 days for Classes B and C. Specimens shall be cured at 77° • } 3°F and 50 • } 5% relative humidity.

Note 2: At conditions of 77° • } 3°F and 50 • } 5% relative humidity.

Note 3: Class C silicone shall also attain its bond strength requirement to asphalt concrete.

Note 4: In cases of dispute, ASTM D2377 shall be used as a referee test. The exposure period in Section 7, Procedure, shall be the tack-free time requirement of this specification.

Bond breakers: The bond breaker shall not stain or adhere to the sealant. Bond breakers shall be either a backer rod or tape identified and used in accordance with the following:

- (a) Backer Rods shall be chemically inert and resistant to petroleum products, solvents, and primers. The bond breaker shall not stain or adhere to the sealant. Bond breakers shall be either a backer rod or tape identified and used in accordance with the following:

1. **Backer Rods:**

Type L - A closed-cell expanded polyethylene foam backer rod. This backer rod may be used with Class A silicone only and is suitable for roadway and structure joints.

Type M - A closed-cell polyolefin foam backer rod which has a closed-cell skin over an open-cell core. This backer rod may be used with all three types of sealants and is suitable for use in roadway and structure joints.

Backer rods shall conform to the following requirements:

| | |
|--------------------------------|----------------------------------|
| Density (ASTM D-1622) | 2.0 lbs./Ft ³ Minimum |
| Tensile Strength (ASTM D-1623) | 25 PSI Minimum |
| Water Absorption (ASTM C-509) | 0.5% by Volume Maximum |

- (b) When required, primer for use with the silicone sealer shall be as recommended by the sealer manufacturer.

Sec. 02212.04 Preformed Expansion Joint Filler shall conform to AASHTO M213.

Sec. 02212.05 Expanded Rubber Joint Filler shall conform to ASTM D1056. Unless otherwise specified, Grades RE43 to RE45 shall be furnished.

Sec. 02212.06 Preformed Neoprene (Polychloroprene) Seal shall conform to ASTM D1056, Grade RE43B 2C(Mod.) E1 Z1. (Modification requires that material shall be manufactured from polychloroprene).

Sec. 02212.07 Polyvinylchloride (PVC) and Polyethylene Joint Fillers shall conform to ASTM D1667. Unless otherwise specified, Grades VE-43 BL to VE-45 BL shall be furnished. Adhesives for use with this material shall be as recommended by the manufacturer.

Sec. 02212.08 Sponge Rubber Joint Filler shall conform to AASHTO M153, Type I. When used in conjunction with bridge bearings, the load required to compress the test specimen to 50 percent of its thickness before test shall not be greater than 100 psi.

Sec. 02212.09 Other Types of Joint Filler may be approved provided they conform to the requirements for the specified type.

Sec. 02212.10 Gaskets For Pipe--

- (a) **Rubber Gaskets** for cast iron and ductile iron pipe and fittings shall conform to AWWA C111 (ANSI A21.11); for concrete sewer and culvert pipe shall conform to ASTM C443; and for other pipe shall conform to AASHTO M198, Type A, and Section 2470.06(d).
- (b) **Preformed Plastic Gaskets** shall conform to AASHTO M198, Type B.

Sec. 02212.11 Preformed Elastomeric Joint Sealer

- (a) **Preformed Elastomeric Joint Sealer--**
 1. Elastomeric Sealer shall be a vulcanized elastomeric compound in which noncrystallizing polychloroprene is used as the sole polymer. It shall be resilient and shall be resistant to heat, oil and ozone.

The shape and size of the sealer shall be as shown on the plans or otherwise specified. No other size or type shall be used except as provided hereinafter or when approved in writing by the COTR. Dimensional tolerances will be those shown on the plans.
 2. Detail Requirements - The seal shall conform to the following as evidenced by samples cut from the finished product:

| Property | Test Procedures | Requirements |
|--|------------------------|---------------------------------------|
| Tensile Strength, psi, min. | ASTM D412 | 2000 |
| Elongation at Break, %, min. | ASTM D412 | 250 |
| Hardness, Durometer A | ASTM D2240 | 55 ∇ 5 |
| Oven Aging, 70 Hrs./212°F | | |
| Tensile Strength, change, max. % | ASTM D573 | -30 |
| Elongation, change, max. % | | -40 |
| Hardness, points change, max. | | +10 |
| Ozone Resistance, 20% Strain 100 pphm in air, 300 hrs./104°F (40°C) (Wipe to with solvent to remove surface contamination) | ASTM D1149 | No Cracks |
| High Temperature Recovery 72 hrs./212°F under 50% deflection | VTM-3 | 85% No Web Adhesion or Cracking |
| Low Temperature Recovery 72 hrs./+14°F under 50% deflection | VTM-3 | 87% |
| Low Temperature Recovery 22 hrs./-20°F under 50% deflection | VTM-3 | 82% |

The seal when tested at a temperature of $70 \pm 5^\circ\text{F}$ shall also conform to the following:

| Use | Deflection Based On Nominal Width % | Pressure Lb./Sq.In. |
|------------|--|--------------------------------|
| Pavement | 20 | 3 min. |
| | 50 | 15 max. |
| Structure | 20 | 4 min. |
| | 50 | 40 max. |

After aging at 212°F (100°C), 70 hrs. at 50% deflection, the seal shall conform to the following:

| <u>Use</u> | <u>Deflection Based On Nominal Width %</u> | <u>Pressure Lb./Sq.In.</u> |
|------------|--|--------------------------------|
| Pavement | 20 | 1.0 min. |
| | 50 | 15 max. |
| Structure | 20 | 1.5 min. |
| | 50 | 40 max.. |

3. Lubricant adhesive for bridge seals shall conform to ASTM D4070.
4. Lubricant for pavement seals shall conform to ASTM D2835.

Sec. 02212.11.A Elastomeric Expansion Dam - The elastomeric sheet gland material shall be virgin ethylene propylene diene monomer (EPDM) or virgin polychloroprene. The elastomeric material shall have the following physical properties:

| Property | Test Procedures | Physical Requirements |
|---|------------------------|------------------------------|
| Tensile Strength | ASTM D412 | 1500 psi min. |
| Elongation at Break | ASTM D412 | 175% min. |
| Low Temperature Brittleness | ASTM D746 | Not brittle at -40° F |
| Oil Deterioration (no requirement for EPDM material) Volume increase after 70 hrs. Immersion in ASTM Oil No. 3 at 212°F | ASTM D471 | 120% max. |
| Ozone Resistance - Exposure to 100 pphm ozone in air for 70 hrs, at 100°F under 20% strain | ASTM D1149 | No Cracks |
| Hardness, Durometer A, | ASTM D2240 | 50-60 |

The elastomeric strip seal gland material shall be preformed non-reinforced, polychloroprene and shall have the following properties.

| Property | Test Procedures | Physical Requirements |
|---|--|-----------------------|
| Tensile Strength | ASTM D412 | 2000 psi min. |
| Elongation at Break | ASTM D412 | 250% min. |
| Hardness, Durometer A, points | ASTM D2240 (Modified) ^{A,C} | 60±5 |
| Oven aging, 70 hrs at 212°F (100°C) | ASTM D573 | |
| Tensile strength, loss, | | 20% max. |
| Elongation, loss | | 20% max. |
| Hardness, Durometer A, points | ASTM D2240 (Modified) ^{A,C} | 0 to +10 |
| Oil swell, ASTM oil 3, 70 hrs at 212°F (100°C) Weight change | ASTM D471 | 45% max. |
| Ozone resistance 20% strain, 300 pphm in air, 70 hrs at 104°F (40°C) | ASTM D1149 (Modified) ^B | No Cracks |
| Low temperature stiffening 7 days at 14°F(10°C) Hardness, Durometer A, points change | ASTM D2240 (Modified) ^{A,C} | 0 to +15 |
| Compression set, 70 hrs at 212°F (100°C) | ASTM D395 Method B (Modified) ^A | 40% max. |
| <p>^A The term "modified" in the table relates to the specimen preparation. The use of the strip seal as the specimen source requires that more plies than specified in either of the modified test procedures be used. Such specimen modification shall be agreed upon by the purchaser and producer or supplier prior to testing.</p> <p>^B Test in accordance with Procedure A of D518 and ozone concentration is expressed in pphm.</p> <p>^C The hardness test shall be made with the durometer in a durometer stand as recommended in Method D2240.</p> | | |

Steel portion of expansion dam shall conform to the requirements of ASTM A709 Grade 36.

Deformed reinforcing steel bars shall conform to the requirements of ASTM A615, Grade 60.

Lubricant adhesive shall be a one-part moisture curing polyurethane compound conforming to the requirements of ASTM D4070.

Fabric reinforcement shall be nonwicking woven polyester material.

Bolts, nuts and washers shall conform to the requirements of ASTM A276, Type 304 Stainless Steel.

Flathead screws shall conform to the requirements of ASTM F 738, Type 304 Stainless Steel.

- (a) **Epoxy Resin System** shall be a two component material conforming to the following requirements based on the epoxy without sand, except for the cure time requirement:

| Property | Test Procedures | Physical Requirements |
|--|-------------------------|------------------------------|
| Pot Life at 77° F (minute) | ASTM C881 Para. 11.2 | 12 min. |
| Initial Cure Time at 77° F w/sand (minute) | | 60 max. |
| Hardness, Shore D | ASTM D2240 | 25 to 65 |
| Elongation (percent) | ASTM D638 | 50% min. |
| Water Absorption, 24 hours % | ASTM D570 | 0.5 max. |
| 3% NaCl Absorption, 24 hours % | ASTM D570 | 0.5 max. |
| ASTM No. 3 Oil Absorption, 24 hours % | ASTM D570 | 0.1 max. |
| Gasoline Absorption, 24 hours % | ASTM D570 | 1.0 max. |

The sand used in the epoxy resin system shall meet the following grading requirements:

| <u>Sieve No.</u> | <u>Percent Passing</u> |
|-------------------------|-------------------------------|
| 16 | 100 |
| 30 | 95 ± 5 |
| 100 | 10 max. |
| 200 | 3 max. |

- (b) **Polyester System** shall be a two component material conforming to the following requirements:

| Property | Test Procedures | Physical Requirements |
|--|-------------------------|-----------------------|
| Pot Life at 77° F (minute) | ASTM C881 Para. 11.2 | 12 min. |
| Initial Cure Time at 77° F w/sand (minute) | | 45 max. |
| Hardness, Shore D | ASTM D2240 | 25 to 65 |
| Elongation (percent) | ASTM D638 | 15% min. |
| Water Absorption, 24 hours % | ASTM D570 | 0.2 max. |
| 3% NaCl Absorption, 24 hours % | ASTM D570 | 0.2 max. |
| ASTM No. 3 Oil Absorption, 24 hours % | ASTM D570 | 0.02 max. |
| Gasoline Absorption, 24 hours % | ASTM D570 | 0.8 max. |

(c) **Two-Component rubberized asphalt** shall conform to the following requirements:

| Property | Test Procedures | Physical Requirements |
|---------------------------------------|-----------------|----------------------------|
| Pot Life at 77°F (minute) | | 25 min. |
| Initial Cure Time at 77°F(minute) | | 60 max. |
| Hardness, Shore A | ASTM D2240 | 20 max. |
| Flow at 140°F (5 hours) | ASTM D1851 | No Flow |
| Bond at 0°F, 3 cycles | ASTM D1851 | 50% min. of original width |
| Water Absorption, 72 hours % | | 0.1 max. |
| ASTM No. 3 Oil Absorption, 24 hours % | ASTM D570 | 0.1 max. |

END OF SECTION 02212

SECTION 02304 - CONSTRUCTION OF DENSITY CONTROL STRIPS

Sec. 02304.01 Description--This work shall consist of constructing one or more control strips in accordance with these specifications for the purpose of determining project density requirements. Compaction will be evaluated using the nuclear field density testing device. Control strips will be required during the construction of subgrades, subbases, aggregate bases and asphalt concrete. Each control strip is to remain in place and become a section of the completed roadway and/or parking lot.

The control strip as well as the remainder of each course for which a control strip is required shall be constructed in accordance with the applicable requirements of these specifications, and the method described herein will be used to determine the density requirements and compliance therewith.

Sec. 02304.02 Materials--The materials used in constructing the control strip(s) for each of the respective courses shall conform to the specified requirements for the material to be used in such courses. Further, the material used in each control strip shall be furnished from the same source and shall be of the same type as the material used in the test sections whose density requirements are established by that control strip.

Sec. 02304.03 Construction--

- (a) **Equipment:** Equipment proposed for use in the compaction of control strips shall be subject to the approval of the COTR prior to use. The type and weight of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer of material being compacted. Compaction of control strips shall be accomplished using the same type and weight equipment to be used on the remainder of that course.
- (b) **Procedure:** The subgrade or pavement structure course upon which a control strip is constructed shall have been approved by the COTR prior to the construction of the control strip.

One control strip shall be constructed at the beginning of work on each roadway and shoulder course and each lift of each course. An additional control strip shall be constructed when a change occurs in the composition of the material from the same source. The COTR reserves the right to require an additional control strip at any time.

The project will be divided into "control strips" and "test sections" by the COTR for the purpose of defining areas represented by each series of tests. The size of each control strip and test section will be established by the COTR based upon the Authority's current control and testing program and local conditions encountered.

Construction of control strips shall be accomplished using the same procedure to be used in the construction of the remainder of that course. Rolling of the control strip shall be continued until no appreciable increase in density is obtained by additional roller coverages.

Upon completion of the rolling, the mean density of the control strip will be based upon 10 tests taken at randomly selected sites within the control strip area using the portable nuclear testing device. Compaction of the remainder of the course shall be governed by the density obtained in the control strip.

Each test section will be tested for required thickness and areas which are deficient more than the specified allowable tolerance shall be corrected in accordance with the applicable requirements of these specifications.

As a minimum, one compaction test section will be required for every lift. The COTR shall also reserve the right to require additional compaction testing in areas which appear to be noncompliant with the specified compaction criteria. Additional testing, if required, shall be considered incidental to the pertinent pay item.

Sec. 02304.04 Compaction Requirements--The density of each test section will be evaluated based upon the results of five tests performed at randomly selected sites within the test section. The mean density obtained for the five tests in each test section shall be at least 98 percent of the mean density obtained in the approved control strip. In addition, each individual test value obtained within a test section shall be at least 95 percent of the mean density obtained in the approved control strip.

Sec. 02304.05 Method of Measurement--This item is considered incidental to the cost of furnishing, placing and compacting the specified course and will not be measured for payment.

Sec. 02304.06 Basis of Payment--The cost for construction of density control strips will be included in the cost of the material for which a control strip is required and no additional compensation will be made for the work described herein. Payment for the material shall be full compensation for performing the work specified and the furnishing of all material, labor, tools, equipment and incidentals necessary to construct the density control strips.

Sec. 02304.07 Field Quality Control -- See Sections 02303.18 and 02308.07.

END OF SECTION 02304

SECTION 02310 - TACK COAT

Sec. 02310.01 Description--This work shall consist of preparing and treating an existing asphalt or concrete surface with asphalt material in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the COTR.

Sec. 02310.02 Materials--Asphalt for tack coat shall be CRS-1, CRS-2, CRS-1h or CSS-1h conforming to the requirements of Section 02210, for emulsions, unless otherwise permitted by the COTR.

Sec. 02310.03 Construction--Equipment for heating and applying asphalt material shall be so designed, equipped, maintained and operated that asphalt material at the specified temperature range may be applied uniformly on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02-gallon per square yard. Distributor equipment shall include a tachometer, pressure gages, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically. A connection shall be provided and hand spraying equipment available to cover inaccessible areas or patches. The distributor shall be equipped with a positive shut-off control which will prevent lapping at the junction of two applications. The distributor shall be equipped when necessary with a positive means of deflecting the spray to prevent the coating of adjacent structures and appurtenances. The maximum application temperature of liquid asphalt material shall conform to the requirements of Table III-1 in this Section..

The existing surface shall be patched, cleaned and rendered free of irregularities to the extent necessary to provide a reasonably smooth and uniform surface. Unstable corrugated areas shall be removed and replaced with suitable patching materials. The edges of existing pavements which are to be adjacent to new pavement shall be cleaned to permit the adhesion of asphalt materials.

Tack material shall be uniformly applied with a pressure distributor designed, equipped, maintained and operated that asphalt material at the specified temperature range may be applied uniformly on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02-gallon per square yard. Distributor equipment shall include a tachometer, pressure gages, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically. A connection shall be provided and hand spraying equipment available to cover inaccessible areas or patches. The distributor shall be equipped with a positive shut-off control which will prevent lapping at the junction of two applications. The distributor shall be equipped when necessary with a positive means of deflecting the spray to prevent the coating of adjacent structures and appurtenances. Tack material shall be applied at a rate of application of between 0.05 and 0.10 gallon per square yard, unless otherwise specified.

TABLE III-1

LIQUID ASPHALT MATERIAL

Maximum Application Temperature

| <u>Grade</u> | <u>Maximum Temperature °F</u> |
|--------------|-------------------------------|
| RC-70 | 180 |
| RC-250 | 220 |
| RC-800 | 225 |
| RC-3000 | 290 |
| MC-70 | 180 |
| MC-250 | 220 |
| MC-800 | 255 |
| MC-3000 | 290 |
| AC-5 | 300 |
| AC-10 | 300 |
| AC-20 | 300 |
| AC-40 | 300 |
| RS-2 | 175 |
| SS-1h | 180 |
| AE-4 | 150 |
| CRS-2 | 175 |
| CSS-1h | 180 |
| CMS-2 | 200 |
| CRS-1h | 175 |
| CRS-1 | 175 |

Tack coat shall be applied in such a manner as to offer the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the asphalt material.

Tack coat shall not be applied during wet or cold weather, or to a wet surface. The quantity, rate of application, temperature and areas to be treated shall be approved prior to application. However, the tack coat shall not be applied immediately prior to the course being placed. The tack coat shall be applied in accordance with the same weather limitations that apply to the course being placed. The quantity, rate of application, temperature, and areas to be treated shall be approved prior to application.

During the application of asphalt material, care shall be taken to prevent spattering adjacent pavements, structures and trees. The distributor shall not be cleaned or discharged into ditches, borrow pits, onto shoulders or along the right-of-way and, when not in use, shall be parked so that the spray bar or mechanism will not drip asphalt materials on the surface of the traveled way.

Sec. 02310.04 Method of Measurement--Tack coat will not be measured for payment but will be considered incidental work pertaining to and included in the Bituminous Concrete items in the Contract.

Sec. 02310.05 Basis of Payment--The cost of furnishing and applying tack coat shall be included in the Bituminous Concrete pay items in the Contract and no additional compensation will be made for the work described herein.

Section 02310.06 Field Quality Control

- A. Conform to all applicable provisions of Section 01400 "Contractor Quality Control Program".

END OF SECTION 02310

SECTION 02315 - ASPHALT CONCRETE PAVEMENT

Sec. 02315.01-Description. This work shall consist of constructing one or more courses of asphalt concrete on the prepared foundation, and constructing hot mix asphalt pavement patches in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or as established by the COTR.

Sec. 02315.02-Materials.

- (a) **Asphalt concrete** shall conform to the requirements of Section 02211. If SUPERPAVE design densities begin to exceed 98 percent of the theoretical maximum density during construction, the Contractor shall alter the design.
- (b) **Asphalt for tack coat** shall conform to the requirements of Section 02310. Asphalt may be changed one viscosity grade by the COTR at no change in the contract unit price.
- (c) **Aggregate Base Material** shall conform to the requirements of Section 02308.

Sec. 02315.03-Equipment.

- (a) **Hauling Equipment:** Trucks used for hauling asphalt mixtures shall have tight, clean, smooth metal bodies equipped with a positive locking metal tailgate. Metal surfaces in contact with asphalt mixtures shall be given a thin coat of an aliphatic hydrocarbon invert emulsion release agent (nonpuddling), a lime solution, or other material on the COTR's list of approved release agents. Except where a nonpuddling release agent is used, the beds of dump trucks shall be raised to remove excess agent prior to loading. Only a nonpuddling agent shall be used in truck beds that do not dump. Each truck shall be equipped with a tarpaulin or other cover that will protect the mixture from moisture and foreign matter and prevent the rapid loss of heat during transportation.
- (b) **Asphalt Pavers:** The asphalt paver shall be designed and recommended by the manufacturer for the type of asphalt to be placed and shall be operated in accordance with the manufacturer's recommendations. Written recommendations pertaining to handling and placing of the mix shall be made readily available on the project site to the COTR. In the absence of manufacturer's recommendations, the recommendations of the National Asphalt Pavement Association shall be followed. The paver (including when screed extensions are used) shall be capable of producing a smooth uniform texture, dense joints and a smooth riding surface.

Pavers shall be capable of smoothing and adjusting longitudinal joints between adjacent strips or courses of the same thickness.

- (c) **Rollers:** Rollers shall be steel wheel, static or vibratory, or pneumatic tire rollers and shall be capable of reversing without backlash. Rollers shall be operated at speeds slow enough to avoid displacement of the mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment that results in excessive crushing of aggregate or marring of the pavement surface will not be permitted.

If, during construction, it is found that the equipment being used mars the surface to the extent that imperfections cannot satisfactorily be corrected or produces permanent blemishes, the use of the equipment shall be discontinued and it shall be replaced with satisfactory units.

- (d) **Rotary Saw:** A gasoline-powered rotary saw with a carbide blade shall be furnished for cutting test samples from the pavement. The Contractor shall furnish gasoline, oil, additional carbide blades, and maintenance for the rotary saw. The Contractor shall cool the pavement prior to sawing the sample. In lieu of a rotary saw, the Contractor may furnish the necessary equipment for coring and testing 4-inch core samples in accordance with VTM 22.
- (e) **Infrared Measuring Instrument:** The Contractor shall furnish a properly calibrated infrared instrument for the purpose of measuring the surface temperature and shall measure the surface temperature.

Sec. 02315.04-Placement Limitations. Asphalt concrete mixtures shall not be placed when weather or surface conditions would prevent proper handling, finishing, or compacting of the mixture. The surface upon which asphalt mixtures are to be placed shall be free of standing water, dirt and mud and the base temperature shall conform to the following.

- (a) When the base temperature is above 80 degrees F, mixture lay down will be permitted at any temperature conforming to the limits of Section 02211 of the Specifications.
- (b) When the base temperature is between 40°F and 80°F, the Nomograph, Table III-2, shall be used to determine the minimum lay down temperature of the asphalt concrete mixes. At no time should the minimum base and lay down temperatures be less than the following:

| Mix Designation | Minimum Base Temperature | Minimum Laydown Temperature |
|-----------------|--------------------------|-----------------------------|
| A | 40°F | 250°F |
| D | 50°F | 270°F |
| E | 50°F | 290°F |
| M | 50°F | 290°F |
| S | 50°F | 290°F |

The maximum temperature of the mixture shall conform to Section 02211.08 of the current specifications.

- (c) When the lay down temperature is between 301°F and 325°F, the number of compaction rollers will be the same number as required for 300°F.

Intermediate and base courses which are placed at rates of application which exceed the application rates shown in Table III-2 shall conform to the requirements for the maximum application rate shown for 8 minute and 15 minute compaction rolling as per number of rollers used.

Should the Contractor be unable to complete the compaction rolling within the applicable 8 minute or 15 minute period, the placing of asphalt mixture shall either cease until sufficient rollers are utilized or other corrective action taken to complete the compaction rolling within the specified period.

All compaction rolling shall be completed prior to the mat cooling down to 175degrees F. Finish rolling may be performed at lower mat temperature.

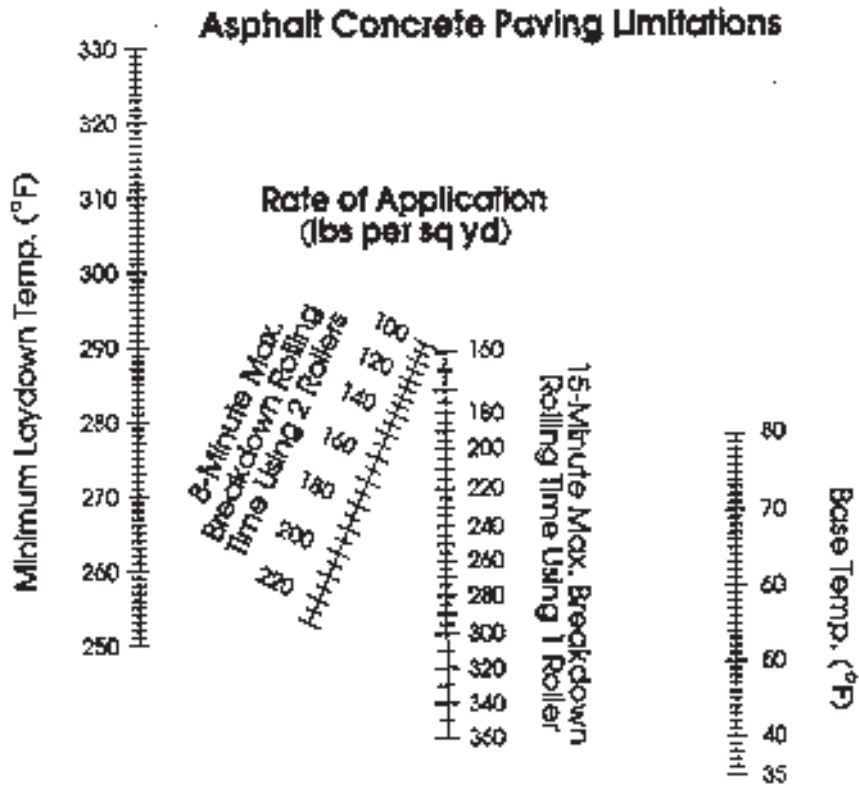
The final asphalt pavement finish course shall not be placed until construction pavement markings are no longer required.

Sec. 02315.05-Procedures.

- (a) **Base Course:** The subgrade or subbase upon which the base course is to be placed shall be prepared in accordance with the applicable provisions of these specifications for such course. The course upon which the pavement is to be placed, including the area that will support the paving equipment, shall be graded and compacted to the required profile.
- (b) **Conditioning Existing Surface:** When the surface of the existing pavement or base is irregular, it shall be brought to a uniform grade and cross section as directed by the COTR. The surface on which the asphalt concrete is to be applied shall be prepared in accordance with the applicable specifications.

When specified, prior to placement of asphalt concrete, longitudinal and transverse joints and cracks in hydraulic cement concrete shall be sealed by the application of an approved joint sealing compound. Contact surfaces of curbing, gutters, manholes, and other structures projecting into or abutting the pavement and cold joints of asphalt shall be painted with a thick, uniform coating of asphalt prior to placement of asphalt mixture.

**Table III-2
Cold Weather Paving Limitations**



1. **Priming existing surface:** Priming of the aggregate base material shall not be required prior to placement of the first course of asphalt concrete base. A tack coat of asphalt shall be applied between the first asphalt concrete base course and each asphalt course placed thereafter. The tack coat shall conform to the applicable requirements of Sections 02310.

Asphalt classed as cutbacks or emulsions shall be applied ahead of the paving operations, and the time interval between applying and placing the paving mixture shall be sufficient to ensure a tacky residue providing maximum adhesion of the paving mixture to the base. The mixture shall not be placed on tack coats that have been damaged by traffic or contaminated by foreign material. Traffic shall be excluded from such sections.

On rich sections or those that have been repaired by the extensive use of asphalt patching mixtures, the tack coat shall be eliminated when directed by the COTR.

Priming: When asphalt concrete to be placed has a total thickness of 4 inches or more, priming with asphalt material will not be required on aggregate subbase or base material.

Tacking: Application of tack at joints, adjacent to curbs, gutters, or other appurtenances shall be applied with a hand wand at the rate of 0.2 gallons per square yard. At joints, the hand wand applied tack shall be 2 feet in width with 4 to 6 inches protruding beyond the joint for the first pass. Tack for the adjacent pass shall completely cover the vertical face of the mat edge, so that slight puddling of asphalt occurs at the joint, and extends a minimum of 1 foot into the lane to be paved. Milled faces that are to remain in place shall be tacked as above for the adjacent pass. Use of tack at longitudinal joint vertical faces will not be required when paving in echelon.

2. **Removing depressions and elevating curves:** Where irregularities in the existing surface would result in a course more than 3 inches in thickness after compaction, the surface shall be brought to a uniform profile by patching with asphalt concrete and thoroughly tamping or rolling until it conforms with the surrounding surface. The mixture used shall be the same as that specified for the course to be placed.

When the Contractor elects to conduct operations to eliminate depressions, elevate curves, and place the surface course simultaneously, he shall furnish such additional spreading and compacting equipment as required to maintain the proper interval between the operations.

- (c) **Placing and Finishing:** Asphalt concrete shall not be placed until the surface upon which it is to be placed has been approved by the COTR.

The edge of the pavement shall be marked by means of a continuous line placed and maintained a sufficient distance ahead of the paving operation to provide proper control of the pavement width and horizontal alignment.

An asphalt paver shall be used to distribute asphalt concrete over the widest pavement width practicable. Wherever practicable and when the capacity of sustained production and delivery is such that more than one paver can be operated, pavers shall be used in echelon to place the wearing course in adjacent lanes. Crossovers, as well as areas containing manholes or other obstacles that prohibit the practical use of mechanical spreading and finishing equipment, may be constructed using hand tools. However, care shall be taken to obtain the required thickness, jointing, compaction, and surface smoothness.

The longitudinal joint in one layer shall offset in the layer immediately below by approximately 6 inches. However, the joint in the wearing surface shall be at the center line of the pavement if the roadway comprises two traffic lanes or at lane lines if the roadway is more than two lanes in width. Offsetting layers will not be required when adjoining lanes are paved in echelon and the rolling of both lanes occurs within 15 minutes after laydown.

Contractor shall have a certified Asphalt Concrete Paving Technician present during paving operations. Immediately after placement and screeding, the surface and edges of each layer shall be inspected and straightedged by the technician and necessary corrections performed prior to compaction. The finished pavement shall be uniform and smooth.

The placement of asphalt concrete shall be as continuous as possible and shall be scheduled such that the interruption occurring at the completion of each day's work will not detrimentally affect the partially completed work. Material that cannot be spread and finished in daylight shall not be dispatched from the plant unless the use of artificial lighting has been approved. When paving is performed at night, sufficient light shall be provided to properly perform and thoroughly inspect every phase of the operation. Such phases include cleaning planed surfaces, applying tack, paving, compacting, and testing. Lighting shall be provided and positioned such as to not create a blinding hazard to the traveling public.

During compaction of asphalt concrete, the roller shall not pass over the end of freshly placed material except when a construction joint is to be formed. Edges shall be finished true and uniform.

Asphalt concrete SUPERPAVE pavement courses shall be placed in layers not exceeding 4.0 times the nominal maximum size aggregate in the asphalt mixture. The maximum thickness may be reduced if the mixture cannot be adequately placed in a single lift and compacted to required uniform density and smoothness. The minimum thickness for a pavement course shall be no less than 2.5 times the nominal maximum size aggregate in the asphalt mixture. Nominal maximum size aggregate for each mix shall be defined as one sieve size larger than the first sieve to retain more than 10 percent aggregate as shown in the design range specified in Section 02211.03 of the Specifications, Table II-13. Base courses to be placed in irregular shaped areas of pavement, such as transitions, turn lanes, crossovers, and entrances may be placed in a single lift.

Overlays in excess of 165 lbs. per square yard or a milled depth greater than 1 1/2 inches shall be squared up prior to opening to traffic.

The milled roadway areas that are to be opened to traffic, excluding curb and gutter sections, shall have drainage outlets cut through the shoulder at locations designated by the COTR. The Contractor shall plan and prosecute the milling operation to avoid the trapping of water on the roadway. Drainage outlets shall be restored to original grade, unless otherwise directed by the COTR. All cost for cutting and restoring the drainage slots in the roadway shoulder shall be included in the price bid for other items of work.

The Contractor shall plan and prosecute a schedule of operations so that milled roadways will be overlaid with asphalt concrete as soon as possible, and, in no instance, shall the time lapse exceed ten (10) days after the milling operations, unless otherwise specified. The milled areas of the roadway shall be kept free of irregularities and obstructions that may create a hazard or annoyance to traffic in accordance with the requirements of Section 02512 of the Specifications.

A short ski or shoe shall be used to match the grade of the newly overlaid adjacent travel lane on all primary, interstate and designated secondary routes. Unless otherwise directed by the COTR, a 24 foot minimum automatic grade control ski shall be used on all asphalt mixtures on all divided highways, with the exception of less than full width overlays and the first course of asphalt base mixtures over aggregate subbases. Care shall be exercised when working along curb and gutter sections to ensure a uniformed grade and joint.

The Contractor shall construct the final riding surface to tie into the existing surface by an approved method, which shall include the cutting of a notch into the pavement. In addition to notching, the Contractor may use an asphalt design containing a fine graded mix to achieve a smooth transition from the new asphalt concrete overlay to the existing pavement, with the approval of the COTR. The material shall be of a type to insure that raveling will not occur. All cost for constructing tie-ins in the asphalt concrete overlay shall be included in the price bid for asphalt concrete.

- (d) **Compacting:** Immediately after the asphalt mixture is placed and struck off and surface irregularities are corrected, the mixture shall be thoroughly and uniformly compacted by rolling.

The surface shall be rolled when the mixture is in the proper condition. Rolling shall not cause undue displacement, cracking, or shoving.

The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The sequence of rolling operations and the selection of roller types shall provide the specified pavement density.

Immediately after the hot mixture is placed, it shall be sealed with rollers. Thereafter, rolling shall be a continuous process, insofar as practicable, and all parts of the pavement shall receive uniform compaction.

Rolling shall begin at the sides and proceed longitudinally parallel to the center of the pavement, each trip overlapping at least 2 the roller width, gradually progressing to the crown of the pavement. When abutting a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. On superelevated curves, rolling shall begin at the low side and progress to the high side by overlapping of longitudinal trips parallel to the center line.

Displacements occurring as a result of reversing the direction of a roller, or from other causes, shall be corrected at once by the use of rakes or lutes and addition of fresh mixture when required. Care shall be taken in rolling not to displace the line and grade of the edges of the asphalt mixture.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with a very small quantity of detergent or other approved material. Excess liquid will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Edges of asphalt pavement surfaces shall be true curves or tangents. Irregularities shall be corrected.

The surface of the compacted course shall be protected until the material has cooled sufficiently to support normal traffic without marring.

(e) **Density:** Density shall be determined in accordance with the following:

1. The Contractor shall perform roller pattern and control strip density testing on surface and intermediate courses in accordance with the requirements of VTM-76. The Contractor shall have a certified Asphalt Field Technician perform all density testing.

Density shall be determined by the backscatter method of testing using a thin-lift nuclear gauge with printer, conforming to the requirements of VTM-81. All density test locations shall be marked in accordance with the requirements of VTM-76. The Contractor shall furnish and operate the nuclear gauge, which shall have been calibrated within the previous 12 months by an approved calibration service. In addition, the Contractor shall maintain documentation of such calibration service for a 12-month period. The required density of the compacted course shall be not less than 98.0 percent and not more than 102.0 percent of the control strip density.

Nuclear density roller pattern and control strip density testing will be performed on asphalt concrete overlays placed directly on surface treatment roadways and when overlays are placed with depths less than 1 inch (nominal application rate of 125 lbs. Per square yard) on any surface. In these situations, sawed plugs or core samples will not be required and the minimum control strip densities as shown in Table III-3 will be waived. The required density of the compacted course shall be not less than 98.0 percent and not more than 102.0 percent of the control strip density.

The project will be divided into "control strips" and "test sections" by the COTR for the purpose of defining areas represented by each series of tests.

- a. **Control strip:** Construction of control strips shall be accomplished in accordance with these specifications and VTM 10.

The term control strip density is defined as the average of 10 nuclear determinations selected at stratified random locations on the control strip.

One control strip shall be constructed at the beginning of work on each roadway and shoulder course and on each lift of each course unless otherwise directed by the COTR. An additional control strip shall be constructed when a change is made in the type or source of materials, or compactive equipment, or whenever a significant change occurs in the composition of the underlying pavement structure or the composition of the material being placed from the same source. Either the COTR or the Contractor may initiate an additional control strip at any time. During the evaluation of the

initial control strip, paving operations may continue. However, paving and production shall be discontinued during construction and evaluation of the additional control strips. In the event that two consecutive control strips fail, subsequent paving operations shall cease until corrective action(s) has been taken with the approval of the COTR. If it is determined with the COTR's approval that the density cannot be obtained because of the condition of the existing pavement structure, the target control strip density shall be determined from the roller pattern that achieves the optimum density and shall be used on the remainder of the roadway that exhibits similar pavement conditions.

Either the COTR or the Contractor may initiate an additional control strip at any time.

The length of the control strip shall be approximately 300 feet regardless of the width of the course being placed. On the first day of construction or beginning of a new course, the control strip shall be started between 500 and 1000 feet from the beginning of the paving operation. The thickness of the control strip shall be the same as the course of which it is to be a part. The control strip shall be constructed using the same paving and rolling equipment and procedures as will be used on the remainder of the course being placed. Every control strip shall remain in place and become a portion of the completed roadway. One nuclear reading shall be taken at each stratified random location. No determination will be made within 1 foot from the edge of any application width or within 18 inches of the edge of any application width for base mixes. The average of these 10 determinations will be the control strip density read to the nearest 0.1 pound per cubic foot. The minimum control strip density shall be determined in accordance with VTM 76.

TABLE III-3
Density Requirements

| Mixture Type | Min. Control Strip Density (%) |
|---------------------|---------------------------------------|
| SM-9.5A, 12.5A | 97.0 |
| SM-9.5D, 12.5D | 96.0 |
| SM-9.5E, 12.5E | 96.0 |
| 1M-19.0 A | 96.0 |
| 1M-19.0 D | 95.0 |

Note: The control strip density requirement is the percentage of the compacted unit weight of the mixture, at the job-mix asphalt content and design voids, as established by the SUPERPAVE design

gyrations for the mixture or as established by the COTR based on two or more field SUPERPAVE tests.

If the control strip density conforms to the requirements of Table III-3 in this section, the control strip will be acceptable and the control strip density shall become the target nuclear control strip density. If the density does not conform to the requirements of Table III-3, the tonnage placed in the control strip and any subsequent paving prior to construction of another control strip will be paid for in accordance with Table III-4 on the basis of the percentage of the Table III-3 value achieved. The Contractor shall take corrective action(s) to comply with the density requirement specified in Table III-3. The COTR will evaluate the foundation conditions when an acceptable control strip density cannot be obtained. If it is determined that the required density cannot be obtained because of the condition of the existing pavement structure, the target nuclear control density will be determined from the roller pattern that achieves the optimum density and will be used on the remainder of roadway that exhibits similar pavement conditions.

TABLE III-4
Payment Schedule for Lot Densities

| % of Target Control Strip Density | % of Payment |
|-----------------------------------|--------------|
| Greater than 102.0 | 95 |
| 98.0 to 102.0 | 100 |
| 97.0 to less than 98.0 | 95 |
| 96.0 to less than 97.0 | 90 |
| Less than 96.0 | 75 |

- b. **Test section (lot):** For the purpose of acceptance, each day's production shall be divided into lots (test section). The standard size of a lot shall consist of 5,000 linear feet of any pass made by the paving train regardless of the width of the pass or the thickness of the course. Pavers traveling in echelon will be considered as two passes. Each lot shall be divided into five sublots of equal length. When a partial lot occurs at the end of a day's production or upon completion of the project, the lot size shall be redefined as follows: If the partial lot contains one or two sublots, the sublots will be added to the previous lot. If the partial lot contains three or four sublots, the partial lot will be redefined to be an entire lot. Each lot shall be tested for density by taking a nuclear density reading from two random locations selected by the COTR within each subplot. Readings shall not be taken within 1 foot of the edge of any application width. The average of the subplot nuclear density readings will be compared to the target nuclear control strip density

to determine the acceptability of the lot. Once the average nuclear density of the lot has been determined, the Contractor will not be permitted to provide additional compaction to raise the average. If two consecutive sublots produce nuclear density results less than 98 or greater than 102 percent of the target nuclear control strip density, the Contractor shall immediately notify the COTR and institute corrective action. By the end of the day's operations, the Contractor shall furnish the test data developed during the day's paving to the COTR.

The tonnage of each lot will be based on the lot's width and length and the mixture application rate as designated in the Contract or as revised by the COTR. Payment will be made for all sublots completed and accepted in place in accordance with the requirements of Table III-4.

The Engineer at any time on any project may perform lot density verification testing. Lot density verification can be performed by using either a nuclear gage or plugs. The Contractor shall be responsible for taking plugs for testing. Testing of the plugs will be done by or in the presence of the Engineer.

2. **Surface, Intermediate, and Base mixes:** When a nuclear gage is used, the Engineer will take 10 stratified random readings per lot. If, based on the average of the 10 readings, the density does not meet the requirement for 100 percent pay or the same pay percentage determined by the Contractor's testing for that lot, the Engineer will take readings at the 10 Contractor sites and then average the readings of the 20 sites. If the density still does not conform to the requirements for 100 percent pay, payment for that lot will be in accordance with Table III-4 on the basis of the Engineer's average of the 20 test results. If the Contractor questions the payment for the lot, the Contractor can request the referee procedure.

The referee procedure shall consist of the Department taking five plugs from the five sites closest to the average of the Engineer's readings of the Contractor and Department sites. The density of the plugs will be determined. If the average density of the plugs does not conform to the requirements for 100 percent pay for the lot in question, payment for that lot will be in accordance with the specifications in Table III-4 on the basis of the percentage of the Table III-3 value achieved.

When plugs are used for lot density verification, five plugs shall be taken per lot. If the density of the plugs does not conform to the requirements for the lot in question, payment for that lot will be in accordance with the specifications in Table III-4 on the basis of the percentage of the Table III-3 value achieved.

3. **Surface, Intermediate and Base Courses** not having sufficient quantity of material to run a nuclear density roller pattern and control strip shall be compacted to a minimum density of 91.5 percent of the theoretical maximum

density as determined by VTM-22. The Contractor shall be responsible for cutting cores or sawing plugs and for testing. If the density is less than 91.5 percent, payment will be made in accordance with the requirements of Table III-5. All results shall be provided to the COTR for approval.

TABLE III-5
Payment Schedule for Surface, Intermediate and Base Courses (Not sufficient quantity to perform nuclear density roller pattern and control)

| %TMD | %of Payment |
|-------------------|-------------|
| Greater than 91.5 | 100 |
| 90.2–91.4 | 95 |
| 88.3–90.1 | 90 |
| Less than 88.2 | 75 |

Any section having mixture (i.e., SM-9.0) being placed at a depth less than 1 inch (125 lbs. per square yard) and not having sufficient quantity to run a nuclear density roller pattern and control strip shall be compacted by rolling a minimum of 3 passes with a minimum 8 ton roller. No density testing will be required.

- (f) **Joints:** Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. A coat of asphalt shall be applied to contact surfaces of transverse joints just before additional mixture is placed against the previously rolled material.

Joints adjacent to curbs, gutters, or adjoining pavement shall be formed by hand placing sufficient mixture to fill any space left uncovered by the paver. The joint shall then be set up with rakes or lutes to a height sufficient to receive full compression under the rollers.

- (g) **Hot Mix Asphalt (HMA) Pavement Patches:** The existing pavement shall be removed with a minimum disturbance to the base material and the faces of the remaining pavement shall be plane without ragged edges. The use of equipment that could damage the existing pavement is prohibited.

The existing pavement shall be removed by making a perpendicular saw cut full depth for the full perimeter of the designated area.

The COTR will evaluate the subgrade to determine if it is suitable as a foundation for the patch. If the COTR determines that the subgrade material is not stable, it shall be compacted as specified in Section 02308 to the satisfaction of the COTR. If the COTR determines that the subgrade material is unsuitable, the Contractor shall replace it with aggregate base conforming to Section 02308. The replacement aggregate material shall be compacted in layers of 4 in. maximum depth. At the Contractor's option, HMA may be substituted for aggregate base. The existing pavement materials that are removed shall be hauled away from the repair site immediately by the Contractor.

The HMA pavement patch shall consist of asphalt concrete base course Type BM-25.0 equivalent in thickness to that of the existing pavement. The HMA base shall be placed in lifts of 3" or less.

Protection of the subgrade after preparation shall be the responsibility of the Contractor. No payment will be made for removal and replacement of subgrade that was not protected.

The Contractor shall have readily available sufficient graded aggregate to completely fill the void of the repair area. The material shall be subject to the approval of the COTR and shall be placed and compacted in the void and covered with a steel plate when directed by the COTR. At the beginning of the next day's work, this material shall be completely removed as directed by the COTR.

The Contractor shall have an ample supply of 12 x 14 ft. x 1 in. (3.7 x 4.6 m x 25 mm) thick steel plates available on the project to cover the patching area in an emergency.

Patch construction shall conform to the applicable portions of Sections 02308 and 02315. Manual operation will be permitted for replacement of the HMA. Cores, control strip, and pavement profile measurements are waived. Equipment, placement, compaction, and quality control procedures will be as approved by the COTR.

Prior to placing the HMA, the exposed vertical surface of all adjacent pavement shall be thoroughly cleaned and all vertical surfaces shall be tack coated in conformance with Section 02310. Each patch shall be as shown on the contract drawings or as directed by the COTR. The HMA mixture may be spread by shovel, by rake or other method approved by the COTR.

HMA shall not be placed on a frozen base.

Acceptance will be determined by nuclear in-place density test data. The nuclear gauge shall be calibrated in conformance with MSMT 417. The Contractor shall take one, one minute special calibration nuclear test from each lift of each patch. Test locations shall be randomly selected from within the patch. A special calibration nuclear test is defined as an average of two (minimum) special calibration readings taken at the same location after rotating the nuclear gauge 180 degrees.

Nuclear test in-place density data shall be expressed as a percentage of the maximum specific gravity determined for each day's production. The in-place density of each patch shall be 92.0 and 97.0 percent.

The results of all nuclear density tests from each patch shall be averaged and compliance will be determined on the basis of each patch tested.

Sec. 02315.06-Pavement Samples. The Contractor shall cut samples from the compacted pavement for testing for depth and density. Samples shall be taken for the full depth of the course at the locations selected

by the COTR. The removed pavement shall be replaced with new mixture and refinished. No additional compensation will be allowed for furnishing test samples and reconstructing areas from which they were taken.

Sec. 02315.07-Pavement Tolerances.

- (a) **Surface Tolerances:** Testing will be performed by using a 10-foot straight-edge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not be more than 1/4 inch. Humps and depressions exceeding the specified tolerance shall be corrected, or the defective work shall be removed and replaced with the new material.

Pavement smoothness will be determined by a profiler on designated lanes having a design speed of 45 miles per hour or higher as specified herein. A straightedge will be used to test intersections, urban areas, transition lanes, and pavement within 52 feet of bridge approach slabs.

For designated pavements, the surface course ride quality acceptance will be based on the lowest average International Roughness Index (IRI) for each 0.01-mile section produced by a minimum of two test runs, using a South Dakota style road profiling device and reported for each travel lane. The device shall measure both wheel paths with laser height sensing instruments. The Department will perform and complete Roughness testing within 30 calendar days of completion of the final surface course and pavement striping over the designated section, providing the Contractor can allow unimpeded access to the paved surface for constant highway speed test runs. Testing shall be conducted in accordance with the requirements of VTM-106.

Acceptance

An IRI number in inches per mile will be established for each 0.01-mile section for each travel lane of the surface course designated by the contract. The 0.01-mile section before and after a bridge, and the beginning and end 0.01-mile sections of the surface course will not be subject to a pay adjustment.

Areas excluded from testing by the profiler will be tested using a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not be more than 1/4 inch. Humps and depressions exceeding the specified tolerance shall be subject to correction as directed by the Engineer, at no additional cost to the Department.

The following table provides the acceptance quality rating scale of pavement based on the final rideability determination.

| IRI After Completion [Inches Per Mile] | Contract Unit Price Adjustment [Percent Pavement Unit Price] |
|---|---|
| 45.0 and Under | 105 |
| 45.1-55.0 | 103 |
| 55.1-70.0 | 100 |
| 70.1-80 | 90 |
| 80.1-90 | 80 |

| | |
|------------|----------------------------|
| 90.1-100.0 | 70 |
| Over 100.0 | Corrective Action Required |

This contract unit price adjustment will apply to the asphalt concrete’s weighted average unit price for the total theoretical tonnage representing the total thickness of the asphalt pavement structure of the 0.01-mi section for the lane width.

When corrections to the pavement surface are required, the Engineer shall approve the Contractor’s method of correction. In order to produce a uniform cross section, the Engineer may require correction to the adjoining traffic lanes or shoulders. Corrections to the pavement surface and/or the adjoining traffic lanes and shoulders will be at no cost to the Department. Methods of correction shall be limited to diamond grinding, remove and replace, and AC overlay.

Where corrections are made after the official Department test, the pavement will be retested by the Department to verify that corrections have produced the acceptable ride surface. No incentives will be provided for sections on which corrective actions have been required. The contractor will have one opportunity to perform corrective action(s). In the event the corrective action(s) do not result in a minimum of 70 percent payment, then the contractor will be assessed the corresponding percent payment based on the following table:

| IRI After Correction (Inches Per Mile) | Contract Unit Price adjustment (Percent Pavement Unit Price) |
|---|---|
| 100.1-120.0 | 60 |
| 120.1-140.0 | 40 |
| 140.1-160.0 | 20 |
| Over 160.0 | 0 |

- (b) **Finished Grade Tolerance:** After placement of the final pavement layer, finished grade elevations shall be within +/-0.04 foot of the elevations indicated in the plans, unless otherwise specified, provided that the actual cross slope does not vary more than 0.20 percent from the design cross slope indicated in the plans and the pavement thickness conforms to the thickness tolerances specified herein.

If determined by the COTR that either the finished grade elevations or cross slope exceed the tolerances specified, the Contractor shall submit to the COTR for approval a plan of corrective action.

- (c) **Thickness Tolerance:** The thickness of the base course will be determined by the measurement of cores as described in VTM 32B.

Acceptance of asphalt concrete base course for depth will be based on the mean result of measurements of samples taken from each lot of material placed. A lot of material is defined as the quantity being tested for acceptance except that the maximum lot size will be 1 mile of 24 foot-width base course.

A lot will be considered acceptable for depth if the mean result of the tests is within the following tolerance of the plan depth for the number inch of tests taken except that each individual test shall be within ± 0.60 inch of the plan depth: mean of two tests, ± 0.45 inch; mean of three tests, ± 0.35 inch; mean of four tests, ± 0.30 inch.

If an individual depth test exceeds the ± 0.60 inch tolerance, that portion of the lot represented by the test will be excluded from the lot. If an individual test result indicates that the depth of material represented by the test is more than 0.60 inch, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the test. If an individual test result indicates that the depth of the material represented by the test is deficient by more than 0.60 inch, correction of the base course represented by the test shall be made as specified hereinafter.

If the mean depth of a lot of material is excessive, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the tests.

If the mean depth of a lot of material is deficient by more than the allowable tolerance, correction will not normally be required and the Contractor will be paid for the quantity of material that has been placed in the lot.

For excessive depth base courses, the rate of deduction from the tonnage allowed for payment as base course will be calculated at a weight of 115 pounds per square yard per inch of depth in excess of the tolerance. For sections of base course that are deficient in depth by more than 0.60 inch and less than 1.50 inch, the Contractor shall furnish and place material specified for the subsequent course to bring the base course depth within the tolerance. This material will be measured on the basis of tonnage actually placed, determined from weigh tickets, and paid for at the contract unit price for the base course material. Such material shall be placed in a separate course. If the deficiency is more than 1.50 inches, the Contractor shall furnish and place base course material to bring the base course thickness within the tolerance. Corrections for deficient base course depth shall be made in a manner to provide a finished pavement that is smooth and uniform.

When the Contract provides for the construction or reconstruction of the entire pavement structure, the surface and intermediate courses shall be placed at the rate of application shown on the plans within an allowable tolerance of ± 5 percent of the specified application rate for application rates of 100 pounds per square yard or greater and within 5 pounds per square yard for application rates of less than 100 pounds per square yard. The amount of material exceeding the allowable tolerance will be deducted from the pay quantities.

When the Contract provides for the placement of surface or intermediate courses over existing pavement, over pavements constructed between combination curb and gutter, or in the construction or reconstruction of shoulders, such courses shall be placed at the approximate rate of application shown on the plans. However, the specified rate of application shall be altered where necessary to produce the required riding quality.

Sec. 02315.08-Measurement and Payment.

Asphalt concrete base for Asphalt Concrete Patching will not be measured for separate payment but will be included in the square yard cost of Asphalt Concrete Patching. See section 02317.

Asphalt concrete surface for milled areas and crossovers will be measured in tons and paid for at the contract unit price per ton. Net weight information shall be furnished with each load of material delivered in accordance with the requirements of Section 02211. Batch weights will not be permitted as a method of measurement unless the Contractor's plant is equipped in accordance with the requirements of Section 02211, in which case the cumulative weight of the batches will be used for payment.

Tack coat shall be included in the price for other appropriate pay items.

Liquid asphalt cement shall be included in the price for other appropriate pay items.

These prices shall include heat stabilization additive and furnishing samples

Payment will be made under:

| <u>Item No.</u> | <u>Pay Item</u> | <u>Pay Unit</u> |
|-----------------|--|-----------------|
| 02315.1 | Asphalt Surface Course, Type SM-12.5D (PG 70-16) | Ton |
| 02315.2 | Asphalt Intermediate Course, Type IM 19.0D | Ton |

Sec. 02315.09 Field Quality Control

(a) Conform to all applicable provisions of Section 01400 A Contractor Quality Control Program.

(b) **Tests:**

The Contractor shall submit to the COTR a quality control plan for this section detailing quality control procedures and tests to assure compliance with the specifications. The Contractor's quality control plan shall have at a minimum the tests outlined. The detailed tests and test procedures to be employed by the Contractor are described below. The tests will be made to the extent determined by the COTR to be necessary. The Contractor shall use the outlined testing procedures. Alternates shall be calibrated and demonstrated on-site and approved by the COTR. The Contractor shall conduct the same number of tests to assure that all the work is in accordance with the plans and specifications, and advise the COTR 24 hours in advance of the areas requiring testing prior to proceeding with the work.

1. Retain a Certified Asphalt Testing Agency to perform testing to determine conformance with these specifications.
2. Each batch of material from the plant shall be delivered with a certificate attesting to conformance with these specifications.
3. A thin lift nuclear density gauge meeting the requirements of VTM-81 shall be used.

4. Control Strips shall be constructed in accordance with VTM-76 and VTM-10.
5. Density readings for asphaltic pavement shall be within 98 to 102 percent of the target nuclear control strip density.
6. The depth of bituminous concrete base course shall be tested using VTM-32B.

(c) **Inspection:**

1. **Field Inspection:** Provide field inspection for operations under this Section to assure compliance with Contract Document requirements and maintain records of field inspections for asphalt concrete pavement work and related construction operations.
 - a. The three phase method inspection shall be used.
 - b. The actual inspection observations shall be documented and a copy of the documentation furnished to the Authority at the end of each day.
 - c. Any work found not to be in compliance with the Contract Documents shall be promptly removed and replaced, or corrected in an approved manner.
 - d. If no variances are detected, this shall be reported.
 - e. If any deficiencies or variances are detected during any inspection, such variances shall be corrected and work affected thereby shall be completely reinspected until work is observed to be in compliance with Contract Document requirements.
 - f. Maintain records of field inspections for materials and construction Operation.
 - g. A copy of these records and Contractor inspections, as well as results of corrective action taken, shall be furnished the Authority.
2. **Field Inspection Procedures:** Inspect work under this Section of the Contract Documents through the CQC Representative and staff for Quality Control.
 - a. All submittals shall be reviewed for conformance with Contract document requirements by the CQC Representative, prior to submission for approval by the Authority.
 - b. Maintain an up-to-date CQC Submittal Status Log at the job site. The CQC Submittal Status Log shall accurately show the status of all submittals required by the Section of the Contract Documents.

3. Preparatory Inspection: Preparatory inspection shall be performed before beginning work and, in addition, before beginning each segment of work. Preparatory inspection shall include a review of the Contract Document requirements, the review and approval of drawings and other submittal data, a check to assure that required control testing has been provided, a physical examination to assure that the as-delivered Asphalt Concrete Pavement to assure all required preliminary work has been satisfactorily completed.
 - a. Check Asphalt Concrete Pavement upon delivery at Project site for conformance to Specifications, Contract Drawings, and compliance to submittals.
 - b. Check storage facilities to assure adequate protection.
 - c. Check Asphalt Concrete Pavement for proper handling and storage to assure adequate protection against damage and deterioration.
 - d. Check to assure that required tests and inspections have been performed and documented.

4. Initial Inspection: Initial inspection shall be performed as soon as a representative segment of the pavement has been placed. Initial inspection shall include performance of scheduled tests, examination of the quality of workmanship, a review for omissions or dimensional errors, and approval or rejection of the initial segment of the work.
 - a. Review a representative sample of the pavement.
 - b. Check for workmanship.
 - c. Check for defective or damaged pavement areas.
 - d. Assure that damaged and/or defective pavement areas are removed from the site and replaced.
 - e. Check placement of asphalt concrete pavement for conformance to specified requirements.
 - f. Note and discuss and deficiencies observed and corrective action to be taken (if corrective action is to be taken and additional initial inspection shall be conducted for compliance).

5. Follow-Up Inspection: Follow-up inspections shall be performed daily and more frequently as necessary, and shall include continued inspection and observations to assure continued conformance with Contract Document requirements.

- a. Check completed work against results of initial inspection of representative sample of work and against items mentioned in the preparatory inspection and in the initial inspection.
 - b. Perform all inspections required to assure that asphalt concrete pavement material is correctly placed without distortions, defects, or damage attributable to carelessness, negligence, or the use of improper construction methods.
 - c. Verify that damaged or defective work is corrected in an acceptable manner to conform to the Contract Documents.
6. Correction of Deficiencies: Correct deficiencies in asphalt pavement work that inspections have indicated as non-conforming. Perform additional inspections, at Contractor's expense, as necessary to reconfirm any non-conformance of original work and to show conformance of corrected work.
- a. Work accomplished shall be considered satisfactory only when the records, tests, and inspections show variances have been corrected in an acceptable manner and that the completed work is in conformance with the Contract Documents.
7. Inspection Results and Acceptance: If, following submission of CQC inspection results, the Authority finds that such inspection reveals a failure of the work to conform to the requirements of the Contract Documents, the material shall be removed and replaced to meet Contract Document requirements or the deficiencies shall be corrected in a manner approved by the Authority.
- a. Although CQC sampling and inspection may be considered evidence of conformance, the Authority will determine whether any work or material deviates from the requirements of the Contract Documents.
 - b. The final and governing determination of conformance or non-conformance with the Contract Documents will be made by the Authority based on CQC Representative inspection results and COTR inspection after the materials have been erected in accordance with Contract Documents.
 - c. Prior to final COTR inspection and acceptance, The Contractor shall deliver a certification, signed by the CQC Representative, to the COTR, attesting that, to the best of his knowledge, information, and belief, and on the basis of observations and inspections all Asphalt Concrete pavement work, except as specifically noted and except for defects not readily ascertainable by the CQC Representative, is complete, is free of substantial mistakes and errors in the work, and is in close conformance with the requirements of the Contract Documents.

END OF SECTION 02315

SECTION 02317 - ASPHALT PAVEMENT MILLING

Sec. 02317.01 Description This item includes milling, hauling and disposal of residue and waste pavement materials and the cleaning of the milled asphalt pavement surface to provide for placement of an overlay. The work shall be accomplished in accordance with these Specifications” and as directed by the COTR.

Milling depth for the Work shall be 2 ½ “. Milling width for each of the two travel lanes shall be of unequal widths as shown on the plans for a total width of forty-eight feet on mainline. Milling width for slip ramps shall be the actual width plus one foot of shoulder each side. Gore areas between travel lanes and slip ramps shall also be milled to a uniform depth of 2 ½” as described herein.

Milling depth shall be at locations where new pavements transition to existing pavements shall be at a constant depth and a paved transition ramp shall be installed prior to opening to traffic.

Sec. 02317.02 Equipment

- (a) **Milling Machine:** The equipment for removing the pavement shall be a commercially designated and manufactured machine capable of performing the work in a manner satisfactory to the COTR to provide a uniformly cut roadway surface capable of handling traffic prior to overlay placement. The machine shall be power-operated and self-propelled, and shall be of sufficient power, traction and stability to remove a thickness of bituminous surface to a specified depth, and provide a uniform profile and cross slope. The machine shall be of a type that picks up and casts milled pavements into a truck, rather than placement on the ground. The ground speeds of the machine and the cutting equipment shall be independent. The equipment shall be capable of milling the surface without causing spalls. The machine shall have a minimum width of 7 feet (2.1 m) and shall be equipped with electronic grade control devices. The machine shall cut vertical edges. The machine shall have a self-contained water system for the control of dust and fine particles.

The machine shall be capable of accurately and automatically establishing profile grades within ½-inch (12 mm) along each edge of the machine by referencing from the design grades by means of a laser or stringline with two directional controls (longitudinal slope and transverse slope). The Contractor shall control the profile grade and depth of milled asphalt on each pass and the finished surface of the remaining asphalt shall not vary more than 3/8-inch (10 mm) when tested with a 16-foot (4.8 m) straight edge applied parallel with or at right angles to the centerline.

The surface resulting from the milling operation characterized by uniform, continuous longitudinal striations or other uniform patterns and shall not be gouged or torn.

- (b) **Sweepers:** The pick-up sweeper shall be a power driven, self-propelled machine that is specifically designed to sweep and pick up debris. The vehicular mounted sweeper shall combine rotating brooms with conveyors and suitable mechanism to pick up loosened material and transport the material into a storage hopper. The sweeper shall be equipped to wet down the loosened material to prevent dust.

The Contractor shall furnish sufficient construction sweepers necessary to thoroughly clean and maintain the Work area, as approved by the COTR. Sweeper bristles shall not be metal.

- (c) **Air Compressor:** The air compressor with wands, for blowing debris from milling grooves, shall be a self-propelled or towed air compressor, to which wands are attached. The nozzles of the wands shall be capable of blowing dust and other debris out of the milling grooves, and away from the cleaning operation, onto an unmilled hard surface where it can be more thoroughly picked up by vacuum/sweeper operations.
- (d) Equipment and vehicles in use under traffic shall be equipped with flashing or rotating amber lights. Trail vehicles shall be equipped with electronic flashing or sequential amber arrows.

Sec 02317.03 Construction

- (a) **Operation:** The construction operation shall be scheduled and proceed in a manner that produces a uniformly finished milled surface with a neat uniform right angle (vertical) cut at the end of the milled section. Milling shall be accomplished in a manner that eliminates joint and crack faults while providing positive lateral drainage by maintaining a constant cross slope between milling extremities.

The milling process shall produce a pavement surface that is true to grade with a uniform texture. The transverse slope of the pavement shall be uniform to a degree that no depressions or misalignment of slope greater than 3/8-inch (10 mm) in 16 feet (4.8 m) are present when tested with a straightedge. The vertical face at the limits of milling at interfaces with existing pavements shall be saw-cut to provide a uniform joint.

The Contractor shall establish positive means for removal of milled residue. Solid residue shall be removed from pavement surfaces and properly disposed of before it is blown by traffic action or wind. Residue shall not be permitted to flow into drainage facilities.

Humps and depressions that exceed the specified tolerances and require additional grinding or planing shall be subject to correction or replacement as directed by the COTR at no additional cost to the Owner.

The shoulder of the mainline shall be squared off 10 feet from the end of the off ramp gore unless otherwise specified herein or as directed by the Engineer.

The Contractor shall ensure positive drainage is provided for all planed surfaces. When planing curb and gutter sections the Contractor shall endeavor to work with existing drainage and grade to maintain positive flow. In the event of significant buildup of standing water the Contractor may be required to erect signage to warn motorists, sweep the roadway to vacate the water, or in extreme cases, close the lane to traffic until proper drainage of the planed surface can be restored.

Temporary transverse pavement-wedge tie-ins shall be constructed where planed existing pavement is to remain temporarily without overlay to the extent allowed or required herein, or elsewhere in the contract documents, or by the COTR. Each tie-in shall be constructed no less than 10 feet in length for every inch of depth of pavement planing performed and shall consist of a mix that is suitable for a riding surface that provides a smooth transition between planed existing pavement and existing pavement or bridge decks. Such tie-ins shall be constructed prior to the planed surface being opened to traffic.

The Contractor will be permitted to leave up to two miles of travel lane of planed surface open to the traveling public provided such planing (milling) is performed across the entire lane width. This length may be increased up to three miles at the COTR's discretion. These same length restrictions shall apply in cases where multiple lane planing is permitted. Under no circumstance will the Contractor be permitted to plane a portion of the width of a travel lane, ramp or loop and leave it overnight. Abutting shoulders may also be planed during single and multiple lane planing operations. Abutting lanes or shoulders shall be squared up regardless of planing depth prior to weekends; except as otherwise permitted herein, and prior to holidays or any temporary shutdowns. Where pavement planing is permitted for multiple lanes the Contractor will be responsible for installing all advance warning signage as detailed within the proposal and temporary traffic lane markings with the exception that temporary line markings shall be a minimum of 2 feet in length and temporary traffic lane markings shall only be Type F paint. The cost for such warning devices, signage and temporary pavement markings shall be included in the cost of other appropriate items.

Where uneven pavement joints exist either transversely or longitudinally at the edges of travel lanes, the Contractor shall provide advance warning traffic control devices to inform the traveling public in accordance with the details provided in the plans for the scope of operation he is performing. The cost for such warning devices shall be included in the cost of other appropriate items.

The following additional restrictions will apply:

- On roadways with a combination of 4 travel lanes and shoulders (i.e. 2 travel lanes and 2 shoulders) in one direction, all lanes and shoulders must be paved back before the weekend.
- On roadways with a combination of 5 or more travel lanes and shoulders (i.e. 3 lanes and 2 shoulders) in one direction 2500 feet of shoulder may be planed and left over the weekend provided the portion of planed shoulder left unpaved over the weekend is paved within 48 hours after the end of the weekend period.
- Ramps and loops shall be performance planed full width by the end of each workday. The Contractor shall pave all ramps and loops that have been performance planed before the weekend.
- Ramps and exits are to be performance planed so that a long longitudinal joint will not be left for vehicles to cross. Ramps and exits are to be performance planed to the extent that the joint crossed is transverse.

In the event an emergency or unforeseen circumstances such as equipment failure or breakdown develop due to the Contractor's operations and within his control that prevent the Contractor from squaring up the planed surface on adjacent lanes prior to a weekend or a holiday any additional signage required to protect the traveling public shall be the Contractor's responsibility and expense.

Only approved mixes that have been verified in accordance with the requirements of the Specifications and have met the requirement for roller pattern density shall be placed on limited access roadways. Where test strips are required, areas shall be squared up at the end of each workday and no planed surface shall be left exposed.

- (b) Clean Up: In addition to the continuous vacuum sweeping at all operational pavements, the Contractor shall clean and remove dust and loose particles from the milled pavement surface by use of vacuum sweepers, rotary pick-up sweepers, air compressors with wands and water trucks.

After the pavement surface has been milled and the milling debris has been removed, the pavement surface shall be cleaned of all dust and debris.

Each piece of equipment shall make as many passes as necessary to clean the pavement to a dust and particle free state, as approved by the COTR.

Immediately prior to placing the tack coat, the pavement shall be swept with the construction sweeper. Insofar as possible, the sweeper operation shall be parallel to the operation of the milling equipment.

All milled material shall become the property of the Contractor and shall be disposed of at a properly licensed facility.

Sec 02317.04 Contractor Quality Control

- (a) The Contractor shall develop a Quality Control Program to control all aspects of milling, pick-up, surface cleaning, and disposal of millings. The Quality Control Plan shall indicate that appropriate action shall be taken when the milling process is believed to be out of tolerance. The Quality Control Plan shall contain a set of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control.
- (b) Depth of mill measurements shall be collected by the Contractor and verified by the COTR along both sides of the milled lane at sufficient intervals to ensure that the equipment and automatic grade controls are performing to provide cuts to the tolerances. The Contractor shall provide all depth measurement data to the COTR at the completion of each work period.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Sec 02317.05 Method of Measurement and Payment

- (a) **Measurement:** Asphalt pavement milling will be measured on the basis of the number of square yards completed as measured in place by the COTR. Pavement milling areas that extend beyond the limits as described in these specifications will not be measured for payment unless the COTR has directed such additional work in writing.

Removal and transporting of milled materials to legal off-site disposal areas will not be measured.

- (b) Payment for pavement milling shall be made at the unit prices per square yard. The prices bid shall be full compensation for furnishing all materials, labor equipment, tools, removal and disposal, and incidentals necessary to complete asphalt pavement milling.

Payment will be made under:

| <u>Item No.</u> | <u>Pay Item</u> | <u>Pay Unit</u> |
|-----------------|-----------------|-----------------|
| 02317.1 | Surface Milling | Square Yard |

END OF ITEM 02317

SECTION 02509 - ASPHALT PAVEMENT PATCHING

Sec. 02509.01 Description--This work shall consist of removing designated areas of defective asphalt concrete pavement and unstable subbase material, replacing subbase material where required, and replacing pavement with asphalt concrete in accordance with these specifications and in reasonably close conformity to the original lines and grades or those established by the COTR.

Sec. 02509.02—Materials.

- (a) Asphalt concrete shall conform to the requirements of Section 02211 except that material may be accepted by certification and visually inspected at the job site.
- (b) Subbase material shall conform to the requirements of Section 02208.
- (c) Liquid asphalt shall conform to the requirements of Section 02310 and Section 02311.

Sec. 02509.03—Procedures.

Asphalt areas shall be patched prior to pavement milling and overlay operations.

Where underlying pavement, existing concrete pavement shall be saw cut and removed 1 foot past the limits of failing paved areas or as directed by the COTR.

Saw cuts shall not extend into adjacent pavement except when repairs are to be extended at that location. Saw cuts shall be straight, neat, vertical, and parallel or perpendicular to the centerline as required. Undisturbed portions of pavement adjacent to the area to be patched shall be left with straight, vertical sides.

Unsuitable subbase shall be removed, disposed of, and replaced in accordance with the requirements of Section 02308, whichever is applicable. Where soil cement subbase is present and sound, excavation below the top of the soil cement line and under adjacent slabs will not be required.

The excavated area shall be thoroughly cleaned before new pavement is placed.

Existing pavement shall not be removed if removal will result in new pavement being placed when the air temperature is below standard paving temperatures according to Section 02315 or as directed by the COTR..

Asphalt Concrete shall be placed on the subgrade and consolidated so that it fills the area of the patch.

As soon as a patched area is finished, the patch and existing pavement for a distance of 8 feet shall be tested by means of a 10-foot straightedge placed parallel to the center line of the road surface. Irregularities in the patch in excess of 1/4 inch shall be corrected.

Asphalt concrete shoulders that are damaged during repair operations shall be reconstructed within 24 hours after completion of a patch in accordance with the requirements of Section 02315 with full-depth SM-12.5D asphalt concrete to match the finished grade. If traffic is to be permitted on the patch prior to reconstruction of the shoulder, the shoulder shall be temporarily repaired to prevent any hazardous condition.

Traffic shall be maintained in accordance with the requirements of Section 02512 or as directed by the COTR.

Sec. 02509.04—Measurement and Payment.

Patching asphalt concrete pavement will be measured in square yards of pavement surface area, complete-in-place, and will be paid for at the contract unit price per square yard. This price shall include saw cutting pavement full depth; removing and disposing of existing asphalt and stone base and or concrete where applicable; undercutting unsuitable material; preparing subgrade; applying liquid asphalt adhesion material; furnishing and installing stone base and asphalt; and finishing patched area to match existing asphalt grade lines to insure a smooth riding surface prior to milling and resurfacing.

Payment will be made under:

| <u>Item No.</u> | <u>Pay Item</u> | <u>Pay Unit</u> |
|-----------------|---------------------------|-----------------|
| 02509.1 | Asphalt Pavement Patching | Square yard |

Sec. 02509.05 Field Quality Control

- A. Conform to all applicable provisions of Section 01400 “Contractor Quality Control Program”.
- B. Submittals
 - 1. Traffic Maintenance plan
 - 2. Material Certifications

END OF SECTION 02509

EXHIBIT P-603 BITUMINOUS TACK COAT

1.0 GENERAL.

This item shall consist of preparing and treating a bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity to the existing lines, grades, and elevations in the field.

1.1 MATERIAL AND PERFORMANCE REQUIREMENTS

The bituminous material shall be either cutback asphalt, emulsified asphalt, or tar, and shall conform to the requirements of Table 1. The type, grade, controlling specification, and application temperature of bituminous material to be used shall be specified by the COTR.

A. TABLE 1. BITUMINOUS MATERIAL

| Type and Grade | Specification | Application Temperature | |
|--------------------|---------------|-------------------------|---------|
| | | Deg. °F | Deg. °C |
| Emulsified Asphalt | | | |
| SS-1, SS-1h | ASTM D 977 | 75-130 | 25-55 |
| CSS-1, CSS-1h | ASTM D 2397 | 75-130 | 25-55 |
| Cutback Asphalt | | | |
| RC-70 | ASTM D 2028 | 120-160 | 50-70 |
| Tar | | | |
| RTCB 5, RTCB 6 | AASHTO M 52 | 60-120 | 15-50 |

B. WEATHER LIMITATIONS

The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 60°F (15°C). The temperature requirements may be waived, but only when so directed by the COTR.

C. EQUIPMENT

The Contractor shall provide equipment for heating and applying the bituminous material.

1. The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10%. Distributor equipment shall include a tachometer, pressure gauges, volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with

a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

2. A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

D. **APPLICATION OF BITUMINOUS MATERIAL.** Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or air blast to remove all loose dirt and other objectionable material.

1. Emulsified asphalt shall be diluted by the addition of water when directed by the COTR and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.
2. The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate of 0.25 gallons per square yard depending on the condition of the existing surface. The type of bituminous material and application rate shall be approved by the COTR prior to application.
3. Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the COTR. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

E. **BITUMINOUS MATERIAL-CONTRACTOR'S RESPONSIBILITY.**

A statement as to the source and character of the bituminous material must be submitted and approved before use of such material begins. The Contractor may be required to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.

1. The Contractor may be required to shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project.

1.2 MEASUREMENT AND PAYMENT

The bituminous material for tack coat shall be considered incidental. Payment for bituminous tack coat shall be incidental and included in the line items for PCC Full Depth, Partial depth repair and mill and overlay repairs.

**EXHIBIT PCC-1 PORTLAND CEMENT CONCRETE
PARTIAL DEPTH REPAIR**

1.0 GENERAL

This work shall consist of repairs to pavement composed of portland cement concrete (PCC). Repair materials shall be applied on a prepared subbase course in accordance with these specifications and shall conform to the existing lines, grades, and thickness in the field or as directed by the COTR.

1.1 MATERIAL AND PERFORMANCE REQUIREMENTS

The partial depth PCC repairs shall generally occur according to the following sequence:

- A. Traffic control prior to initiating the repair work shall be in accordance with Section 5.0 in the attached Statement of Work.
- B. All areas must include saw cutting, demolition, and removal of deteriorated PCC. All excavated and/or demolished material shall be removed and disposed of off airport property by the Contractor to an approved disposal site at the end of each workday.
- C. The depth of the repairs shall be a minimum of 2 inches and a maximum of 6 inches.
- D. For Emergency Repairs, HMA or cold applied asphalt patch material may be used up to 6 inches in depth as directed by COTR. The Contractor is not required to furnish a vacuum truck, but may hand broom clean the area of all construction debris.
- E. As directed by the COTR, the Contractor may use approved plant-produced bituminous patching mixture as fill material for pothole repairs. Cold patch materials may be used as directed by the COTR. This item shall include priming/tacking the repair area as required; and supplying, placing, and compacting the bituminous concrete once the partial depth PCC demolition phase has been completed.

1.2 MEASUREMENT AND PAYMENT

Accepted PCC repairs shall be measured on a square footage basis of pavement repaired at the indicated repair depth. Payment shall be made on a square foot basis at the depths indicated below. Therefore, there will be five bid items for partial depth PCC repairs.

Cost Schedule Items

- 2a. 2 to 6 inch depth, Hot Mix Asphalt, SF
- 2b. 2 to 6 inch depth, Cold Patch, SF

EXHIBIT P-605 JOINT SEALING FILLER

1.0 GENERAL

This item shall consist of the removal of existing sealant and backer rod, joint cleaning to include sandblasting and wire brushing, priming the joint surfaces, and providing and installing a resilient and adhesive joint sealing filler capable of effectively sealing joints in pavements in accordance with the sealant manufacturer's recommendations and these contract documents. In addition to these performance requirements, the Contractor shall provide the necessary labor, materials, and equipment to perform the other work repairs as stipulated in the Contractor's work plan.

1.1 MATERIAL AND PERFORMANCE REQUIREMENTS

Joint sealing materials shall conform to Figure 1.1 (Sawed Joint and Sealing Filler Detail) and the types listed below for all joints.

- A. Joint sealing material for all construction joints, contraction joints, and expansion joints at structures shall conform to ASTM D 5893-96-Cold Applied, Single Component, and Chemically Curing Silicone Joint Sealant for Portland Cement Concrete (PCC) pavements as modified in Table 1 below. Self-leveling, type SL sealants or tool grade will be acceptable for use as directed by the COTR. Backer rod shall be installed at the construction joints and contraction joints. Backer rod shall not be installed at expansion joints.
- B. Each lot or batch of sealing compound shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and shall be accompanied by the manufacturer's certification stating that the compound meets the requirements of this specification.

As supplied:

| Test Method | Test | Material Requirement |
|-------------|-------------------------------|----------------------|
| ASTM D 1475 | Specific Gravity | 1.26-1.34 |
| Mil-S-8802 | Extrusion Rate, grams/minute | 275-550 |
| CTM 0098 | Skin Over Time, minutes, max | 60 |
| CTM 0208 | Non-volatile Content, minimum | 96 |

Upon complete cure (sample cured 21 days at 77 degrees +/- 2 degrees F and 50 +/-5% relative humidity.)

| | | |
|------------------------------------|--|------|
| ASTM D 412, Die C, modified | Elongation, % minimum | 1400 |
| ASTM D 3583 (Section 14, modified) | Joint modulus at 50% elongation, psi (kPa), max | 7 |
| ASTM 3583 (Section 14 modified) | Joint modulus at 100% elongation, psi (kPa), max | 8 |
| ASTM 3583 (Section 14 modified) | Joint modulus at 150% elongation, psi (kPa), max | 9 |
| ASTM 3583 (Section 14 modified) | Adhesion to concrete, minimum % elongation | 600 |

Performance:

| | | |
|------------|--|----------------------------------|
| ASTM C 719 | Movement, 10 cycles at +100/- 50% | No failure |
| ASTM C 793 | Accelerated Weathering, at 5,000 hours | No cracks, blisters or bond loss |

B. Joint sealing material for all Type B expansion joints shall conform to ASTM D 2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1. The joint seal shall be a vulcanized elastomeric compound using polychloroprene as the only base polymer. ASTM D 2628, Die “D” shall be used to prepare specimens for the strength and elongation tests.
2. The size, shape, and dimensional tolerances of the joint seal shall be as follows:

Type B Expansion Joints

- a. Ability to be installed in saw cuts representative of existing field conditions.
 - b. Uncompressed height of seal less than or equal to 2.5 inches.
 - c. Minimum allowable expanded width of seal (joint) greater than or equal to 2.125 inches.
3. Each lot of preformed joint sealer delivered to the jobsite shall be

accompanied by the manufacturer's certification stating that it meets the requirements of this specification.

The manufacturer shall certify that the preformed seal will exert a minimum pressure of 3 pounds per square inch when compressed to 80% of nominal width and a maximum of 25 pounds per square inch when compressed to 50% of nominal width.

- C. As directed by the COTR, the contractor may also use hot applied asphalt for joint sealing. Joint sealing material for all construction joints, contraction joints, and expansion joints at structures shall conform to ASTM D-3405 hot applied asphalt. Backer rod shall be installed at the construction joints and contraction joints. Backer rod shall not be installed at expansion joints.
- D. LUBRICANT. Lubricant for installation of preformed joint seal shall be an one-component polychloroprene compound containing only soluble phenolic resins blended together with anti-oxidants and acid acceptors in aromatic hydrocarbon solvent mixture and shall meet the following requirements:
1. Requirements ASTM

| | | |
|-----------------------------------|------------|-----------------|
| Average weight per gallon, pounds | 7.8 | |
| Solids content, percent by weight | 22-28 | D1644, Method A |
| Film strength, psi | 2,300 min. | D412 |
| Elongation, percent | 750 min. | D412 |
 2. Each shipment of lubricant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and the date of manufacture and shall be accompanied by the manufacturer's certification stating that the lubricant meets the requirements of the specification.
 3. This lubricant shall be stored at a temperature between 50°F (10°C) and 80°F (30°C) and shall be used within 270 days of its manufacture.
- E. PRIMER FOR SILICONE SEALANT. An air-drying prime coat, meeting the recommendations of the manufacturer of the silicone joint sealant, shall be applied to the joint prior to applying the joint sealant material.
- F. BACKER ROD MATERIAL. A backer rod in the bottom of the joint to be filled shall be used to control the depth of the sealant, to achieve the desired shape factor, and to support the sealant against indentation and sag. Backer materials shall be compatible with the sealant, should not adhere to the sealant, should be compressible without extruding the sealant and should recover to maintain contact with the joint faces when the joint is open. Backer rod material shall meet the requirements of ASTM D 5249.

1.2 CONSTRUCTION METHODS

Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be above 40°F at the time of installation of the preformed joint seal and above 50°F at the time of installation of the poured joint sealing material. If the pavement must be opened to traffic prior to placement of the sealant, the Contractor shall re-clean the joint before sealing.

- A. **PREPARATION OF JOINTS. All existing joint sealer and backer rod shall be removed.** Immediately before sealing, the joints shall be thoroughly cleaned of all laitance, curing compound, and other foreign material. Cleaning shall be accomplished by sandblasting and wire brushing. Upon completion of cleaning, the joints shall be blown out with compressed air. The joint faces shall be surface dry when the seal is applied.
- B. **APPLICATION OF PRIME COAT.** When required, apply prime coat to clean, dry surfaces by dipping, brushing or spraying. The coverage rate shall meet the recommendations of the manufacturer. Allow the primer to completely dry until all the solvent evaporates. This time will vary depending on the humidity conditions and the porosity of the surface being primed.
- C. **INSTALLATION OF SEALANTS.** Joints shall be inspected for proper width, depth, alignment, and preparation, before sealing is continued. Sealants shall be installed in accordance with the following requirements:
 1. **Silicone Sealants.** The joint sealant shall be applied uniformly solid from bottom to top and shall be filled without formation of entrapped air or voids. A backing material shall be placed as shown on the plans and shall be nonadhesive to the concrete or the sealant material. Sealants shall be applied to pavement joints by use of appropriate types of pressure fed application systems. Sealant supplied in caulking tubes may be applied using hand or pneumatic types of caulking guns. Sealant supplied in pails or drums shall be applied using a pneumatic pumping system that feeds the sealant through an application hose and wand with a nozzle that is placed in the joint. Any sealant spilled on the surface of the pavement shall be removed immediately. Sealant, which does not bond to the prepared concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition, will be rejected and replaced by the Contractor at no additional cost to the Authority. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing and placing the sealant will produce a satisfactory joint seal.
 2. **Preformed Elastomeric Joint Seals.** Preformed joint sealer shall be placed using equipment capable of installing the sealer in the upright position,

without cutting, nicking, distorting, or otherwise damaging the seal. Lubricant shall be applied to the concrete or the preformed seal, or both, and the seal shall be installed in a substantially compressed condition and at the depth below the surface of the pavement as shown in Figure 1.1 (Sawed Joint and Sealing Filler Detail) of Attachment 3. The method of installation shall be such that the joint sealer will not be stretched more than 5% of the minimum theoretical length, or compressed more than 2%. The method of installation shall be checked for stretching or compression, using transverse joint sealer. The check shall consist of installing sealer in five joints of at least 25 feet in length, removing the sealer immediately after installation, and checking the length. This check may be modified by pre-marking or pre-cutting the sealer to length prior to installation if this is compatible with the equipment being used. If the measured length of any of these five sealers indicated that the sealer is stretched or compressed beyond these limits, the installation shall be modified to correct the situation. Once satisfactory sealing operations have started, one joint length per every one hundred shall be removed and checked. If the limits are exceeded, the joint sealers on either side should be removed until the condition disappears. The affected joints shall be resealed in a satisfactory manner at no cost to the Authority, and the method of installation shall be checked again for satisfactory procedure. The seal shall be installed in the longest practicable lengths.

3. Hot Applied Sealants. The joint sealant shall be applied uniformly solid from bottom to top and shall be filled without formation of entrapped air or voids. A backing material shall be placed as shown on the plans. Sealants shall be applied to pavement joints by use of appropriate types of pressure fed application systems. Sealant supplied in caulking tubes may be applied using hand or pneumatic types of caulking guns. Sealant supplied in pails or drums shall be applied using a pneumatic pumping system that feeds the sealant through an application hose and wand with a nozzle that is placed in the joint. Any sealant spilled on the surface of the pavement shall be removed immediately. Sealant, which does not bond to the prepared concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition, will be rejected and replaced by the Contractor at no additional cost to the Authority. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing and placing the sealant will produce a satisfactory joint seal.
- D. STORAGE OF SEALANTS. Sealant materials shall be stored in the original, unopened containers supplied by the manufacturer prior to use. Containers shall be opened for only the minimum amount of time practical prior to application. The sealant shall be stored in accordance with the recommendations provided by the manufacturer to maintain storage stability.

1.3 MEASUREMENT AND PAYMENT

Payment for Joint Sealant shall be included in Cost Schedule Line Item numbers 4a and 4b Joint sealing for purposes of re-establishing joints during partial and full depth pavement repairs should be considered an incidental.

SECTION CS-1 CRACK SEALING FOR BITUMINOUS CONCRETE PAVEMENTS

1.0 GENERAL

This work shall consist of crack sealing composed of anionic and cationic emulsified asphalts (slurry mix) applied to an existing bituminous concrete pavement surface crack in accordance with these specifications.

1.1 MATERIAL AND PERFORMANCE REQUIREMENTS

Crack sealing material shall consist of liquid mixtures of asphalt cement, water, and an emulsifying agent (collectively referred to as an asphalt emulsion). The Contractor shall apply rapid setting (RS), or proprietary quick setting (QS) graded asphalt emulsions as directed by the COTR. The COTR shall determine the type, either anionic or cationic, of asphalt emulsion the Contractor is to use based on existing bituminous concrete aggregate characteristics.

The crack sealing repair procedures shall generally occur according to the following sequence. Hairline cracks less than ¼ inch in width are excluded from this crack sealing procedure. Cracks greater than two inches in width shall be repaired in accordance with the bituminous concrete repair requirements, Specification Exhibit BC-1.

- A. Traffic control prior to initiating the repair work shall be in accordance with Specification Section 3.3.1.1, number 10, Barricades, in the attached Statement of Work.
- B. Rout out the crack to the sealant manufacturer's specifications for width to depth ratio. As a general guide, the Contractor shall rout cracks to 1/8 inch greater than the average width of the crack for cracks that are 1/8 to 3/4 inches wide. Routing provides a good sealant reservoir and reduces raveling potential. It shall not be necessary to rout cracks larger than 3/4 inches in width. If necessary, the Contractor shall remove any old sealant as directed by the COTR.
- C. The Contractor shall clean the crack using high-pressure air or hot air blasting, as directed by the COTR. Hot air blasting shall be done using a hot compressed-air (HCA) lance, or heat lance, connected to an air compressor. The crack shall be thoroughly cleaned to the satisfaction of the COTR.
- D. After removing the old sealant and/or cleaning the cracks, the Contractor shall check them for depth. If the cracks are over 3/4 inches deep, a backer rod shall be installed to conserve sealant as directed by the COTR. The backer rod shall be a compressible, non-shrinking, non-absorbent material with a melting point

higher than the sealant temperature. The backer rod shall be 1/8 inch larger than the crack so it doesn't slip down, or float out after installing the sealant.

- E. Immediately before applying the sealant, the Contractor inspects the crack to ensure the crack(s) are clean, dry, and any backer rod material is correctly installed. If the cracks are left unsealed for more than 12 hours, the Contractor shall re-clean the crack using compressed air to the satisfaction of the COTR.
- F. Cracks shall be sealed with modified asphalt materials and specially prepared crack sealing materials meeting ASTM Specification D6690, D5078, or AASHTO Specification M173. The Contractor shall apply the sealant from the bottom to the top of the crack to prevent air bubbles from forming and creating a weak spot in the sealant. The Contractor shall use a sealant kettle that has an injection wand to accomplish the sealant placement. The Contractor shall use a squeegee to remove any excess sealant on the pavement surface. The sealant shall be allowed to cure in accordance with the manufacturer's requirements prior to opening to traffic. The Contractor shall immediately clean any sealant that is tracked during the crack sealant operation. The Contractor at no additional cost to the Authority shall repair any crack sealing areas damaged due to Contractor negligence.

1.2 MEASUREMENT AND PAYMENT

Accepted crack sealing repairs shall be measured on a linear foot basis of pavement repaired. Payment shall be made on a linear foot basis for routed crack sealing and non-routed crack sealing. Therefore, there will be two bid items for crack sealing for bituminous concrete pavement repairs; one for routing the cracks prior to crack sealing and another for simply sealing the cracks. Cracks are to be a maximum of 1-1/2 inches wide. Widths greater than that shall be repaired as spalls. Payment shall be full compensation for all labor, materials, tools, equipment, cleaning, traffic control (barricading), and incidentals required to complete the repair work as specified herein. Backer rod material and installation shall be paid for as a separate line item.

1.3 PAY ITEMS:

Crack sealing, bituminous concrete, emulsified asphalt.
Cost Schedule Items:

- 3a. Cracks 1/4 to 1 1/2 inch wide, rout, clean, seal
- 3b. Backer rod, add for cracks > 3/4 in depth; per LF

**EXHIBIT CS-2 CRACK SEALING
FOR PORTLAND CEMENT CONCRETE PAVEMENTS**

1.0 GENERAL

This work shall consist of crack sealing existing portland cement concrete (PCC) pavement surface cracks in accordance with these specifications.

1.1 MATERIAL AND PERFORMANCE REQUIREMENTS

Crack sealing material shall conform to specification Exhibit P-605 Joint Sealing Filler; subsection 605-2.1 JOINT SEALERS (MATERIALS). Cracks greater than 2 inches in width shall be repaired in accordance with the Portland Cement Concrete (PCC) repair requirements, Specification Section PCC1.

The crack sealing repair procedures shall generally occur according to the following sequence. The Contractor shall be responsible for removing and disposing of the old sealant prior to sealing the crack.

- A. Traffic control prior to initiating the repair work shall be in accordance with Specification 3.3.1.1, number 10, Barricades in the attached Statement of Work.
- B. Cracks less than 1/8 inch in width with minor spalling shall be blown out and sealed.
- C. Cracks 1/8 inch to 1/2 inch in width shall be sawed, cleaned and sealed. If there is minor spalling present, refer to specification section PCC-1 Portland Cement Concrete Pavement Partial Depth Repair. The saw cutting equipment shall be approved by the COTR prior to its use. As a general guide, the Contractor shall saw cracks to 1/8 inch greater than the average width of the crack for cracks that are 1/8 to 1/2 inches wide. Saw cutting is to provide a good sealant reservoir and reduces raveling potential.
- D. Cracks greater than 1/2 inch in width shall be sawed, cleaned and sealed, the Contractor using a backer rod to conserve sealant as directed by the COTR. If there is major spalling, repair in accordance with specification section PCC-1 Portland Cement Concrete Pavement Partial Depth Repair.
- E. The Contractor shall saw the crack with the appropriate equipment then clean the crack using sandblasting techniques. The cracks shall be blown cleaned prior to being sealed. The Contractor shall follow the sealant manufacturer's specifications for width to depth ratio.

- F. Check them for depth: A backer rod shall be installed to conserve sealant for all saw cut operations. The backer rod shall conform to specification Exhibit P-605 JOINT SEALING FILLER; subsection 605-2.4 BACKER ROD MATERIAL. The backer rod shall be 1/8 inch larger than the crack so it doesn't slip down, or float out after installing the sealant.
- G. Immediately before applying the sealant, the Contractor shall inspect the crack to ensure the crack(s) are clean, dry, and any backer rod material is correctly installed. If the cracks are left unsealed for more than 12 hours, the Contractor shall re-clean the crack using compressed air to the satisfaction of the COTR.
- H. Cracks shall be sealed with modified asphalt materials and specially prepared crack sealing materials meeting ASTM Specification D6690, D5078, or AASHTO Specification M173. The Contractor shall apply the sealant from the bottom to the top of the crack to prevent air bubbles from forming and creating a weak spot in the sealant. The Contractor shall use a squeegee to remove any excess sealant on the pavement surface. The sealant shall be allowed to cure in accordance with the manufacturer's requirements prior to opening to traffic. Any sealant that is tracked during the crack sealant operation shall be immediately cleaned by the Contractor. The Contractor, at no additional cost to the Authority, shall repair any crack sealing areas damaged due to Contractor negligence.

As an alternate crack material for PCC, cracks 1/8 to 1-1/2 inches wide, the Contractor may use emulsified asphalt as directed by the COTR. The material, cleaning and sealing shall be paid per lineal foot.

1.2 MEASUREMENT AND PAYMENT

Accepted crack sealing repairs shall be measured on a linear foot basis of pavement repaired. Payment shall be made on a linear foot basis for sawed crack sealing and non-sawed crack sealing. There will be six bid items for crack sealing for PCC pavement repairs.

Cost Schedule Items:

- 4a. Emulsified asphalt material, cracks 1/8 to 1-1/2 inches wide, clean, seal; per LF
- 4b. Backer rod, add for Cracks > 3/4 in depth; per LF

Cracks are to be a maximum of 1-1/2 inches wide. Widths greater than that shall be repaired as spalls. Payment shall be full compensation for all labor, materials, tools, equipment, cleaning, traffic control (barricading), and incidentals required to complete the repair work as specified herein.

EXHIBIT CSR-1 CURB AND SIDEWALK REPAIR

1.0 GENERAL.

This item shall consist of the removal and replacement of existing sidewalk, curb and gutter, and other miscellaneous items.

1.1 MATERIAL AND PERFORMANCE REQUIREMENTS

Asphalt and Portland cement concrete paving, walks, and curbs: The existing material to be removed shall be freed from the adjacent material to remain. Saw through the full depth of the material to be removed including any load transfer devices. The equipment shall not cause damage to the adjacent materials to remain in place.

Meet the requirements of the reference VDOT standards, Division V, Incidental Construction Section 508 (Demolition of Pavement and Obscuring Roadway).

Comply with all Local, State, and Federal laws, rules and regulations applicable to this section and to the demolition work to be done.

1.2 MEASUREMENT AND PAYMENT

Repairs to curb and gutters, and sidewalks to include demolishing and replacing material shall be fully loaded into the Cost Schedule Items:

- 7a. PCC Sidewalk, 4" thick, SF
- 7b. VDOT CG-2, Demolition and replacement, LF
- 7c. VDOT CG-6, Demolition and replacement, LF
- 7d. VDOT CG-12, Demolition and replacement, EA
- 8a. PCC Sidewalk, 4" thick, excavate & install new, SF
- 8b. VDOT CG-2, excavate & install new, LF
- 8c. VDOT CG-6, excavate & install new, LF
- 8d. VDOT CG-12, excavate & install new, EA

**EXHIBIT BC-1
BITUMINOUS CONCRETE PAVEMENT**

1.0 GENERAL.

This item shall consist of constructing one or more courses of bituminous (asphalt) concrete, including asphalt patching, on the prepared foundation in accordance with these specifications and drawings 1.1 or as established by the Contracting Officer's Technical Representative (COTR).

1.1 MATERIAL AND PERFORMANCE REQUIREMENTS

Asphalt patching material shall conform to Virginia Department of Transportation (VDOT) Road and Bridge Specifications, Division II, Section 211, Superpave Type SM 9.5, IM-19.0 or other relatively fine graded mix approved by the COTR. Fine Aggregate: Sharp edged natural sand or sand prepared from stone, gravel or combination thereof, complying with AASHTO M6. Soundness loss shall be a maximum of 15% per AASHTO T103 or 25% per AASHTO T104. Premixed packaged cold patch material may be used as directed by the COTR.

- A. **PREPARATION OF THE UNDERLYING SURFACE.** Immediately before placing the bituminous mixture, the underlying course shall be cleaned of all dust, debris, and standing water using hot compressed air. A tack coat or prime coat shall be applied as directed by the COTR.
- B. **TRANSPORTING, PLACING AND FINISHING.** The bituminous mixture shall be transported from the mixing plant to the site in trucks with tight, clean, and smooth metal beds. Adequate artificial lighting shall be provided for night placement. The mix shall be placed and compacted at a temperature suitable for obtaining surface smoothness and other specified requirements. After placing the mixture, the mixture shall be thoroughly and uniformly compacted.
- C. **PLACEMENT LIMITATIONS.** Bituminous concrete mixtures shall not be placed when weather or surface conditions would prevent proper handling, finishing, or compacting of the mixture. Bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than 45°F for thickness up to 3 inches and 40°F for thickness greater than three inches.
- D. **QUALITY ASSURANCE.** Meet requirements of the referenced standards except to the extent more detailed or stringent requirements are indicated by the Contract Documents.

- E. SUBMITTALS. Furnish manufacturers data test reports and materials certifications as required in the reference section including:
 - 1. Bituminous Concrete Job Mix Formulas
 - 2. Plant tickets
 - 3. Packaged Cold Patch Material

1.2 MEASUREMENT AND PAYMENT

METHOD OF MEASUREMENT. Bituminous concrete pavement shall be measured by the square foot of bituminous material used in the accepted work. Payment for accepted bituminous concrete pavement shall be made at the unit price per square yard. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Bituminous concrete repairs Cost Schedule Items:

- 1a. 4-6 inch depth, HMA, per SF
- 1b. 4-6 inch depth, Cold Patch, per SF

**VDOT SECTION 316
HYDRAULIC CEMENT CONCRETE PAVEMENT**

316.01—Description

This work shall consist of constructing pavement and approach slabs composed of hydraulic cement concrete, with or without reinforcement as specified, or a continuously reinforced pavement on a prepared sub-grade or base course in accordance with the requirements of these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or as established by the Engineer.

316.02—Materials

- (a) **Concrete** shall be central mixed and shall conform to the requirements of Table II-17 for Class A3 paving concrete except that the slump shall not be more than 2 inches for placement by the slip form method. Concrete for placement by the slip form method shall be sufficiently cohesive to prevent detrimental sloughing at the pavement edges as the forms advance. Transit mixed concrete may be furnished for use in constructing approach slabs, ramps, transitions, connections, crossovers, and other miscellaneous pavement. Aggregate used in concrete for pavement and approach slabs that are used as riding surfaces shall be non-polishing aggregate.
- (b) **Reinforcing steel dowels, tie bars, hook bolts, and welded wire fabric** shall conform to the requirements of Section 223.
- (c) **Wide flange beams** used in the anchor slab of continuously reinforced pavement shall conform to the requirements of ASTM A36.
- (d) **Joint sealer and filler** shall conform to the requirements of Section 212.
- (e) **Load transfer devices** shall be fabricated of steel and shall be of an approved type and design.
- (f) **Curing materials** shall conform to the requirements of Section 220.

316.03—Equipment

Equipment and tools necessary for handling materials and performing the work shall be subject to the approval of the Engineer. The Contractor shall provide the equipment and tools specified herein, or their approved equivalent, and they shall be of such capacity that the rate of placing concrete and finishing pavement will be continuous. If any piece of equipment does not have sufficient capacity to keep pace with the other operations, the Contractor shall limit the size of the batch or otherwise limit the rate of production to preclude poor workmanship or frequent delays.

- (a) **Forms:** Straight side forms shall be made of metal at least 7/32 inch in thickness and shall be furnished in sections at least 10 feet in length. Forms shall have a depth at least equal to the prescribed edge thickness of the concrete, without horizontal joints, and a base width equal to at least the depth of the forms. Flexible or curved forms of proper radius shall be used for curves with a radius of 100 feet or less. Flexible or curved forms shall be of a design acceptable to the Engineer. Forms shall be provided with adequate devices for secure placement so that when set they will withstand the impact and vibration of consolidating and finishing without visible springing or settlement. Flange braces shall extend outward on the base at least 2/3 the height of the form. Forms that are bent, twisted, or broken or that have battered top surfaces shall be removed. Repaired forms shall not be used until inspected and approved. Built-in forms shall not be used except where the total area of pavement on the project is less than 2,000 square yards. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the vertical side shall not vary from a true plane more than 1/4 inch. Forms shall contain provisions for locking the ends of abutting form sections together tightly and for secure setting.
- (b) **Sub-grade Machine:** The machine shall be of an approved mechanical type, capable of preparing the sub-grade to within 1/4 inch of the grade shown on the plans or established by the Engineer.
- (c) **Sub-grade Roller:** The roller shall be of an approved type and capable of obtaining the required density.
- (d) **Bulkheads:** Bulkheads for construction joints shall be of sufficient strength to prevent deformation of the joint and shall be constructed to permit dowels or other reinforcement to extend through the joint.
- (e) **Work Bridges:** Work bridges shall be provided by the Contractor.
- (f) **Mechanical Spreader:** The mechanical spreader shall be a self-powered, self-propelled unit capable of placing the concrete mechanically on the sub-grade over the full width and depth of the pavement. The spreader shall be equipped with a hopper or other type of spreading equipment that will distribute the concrete over the sub-grade without segregation. The concrete shall not be placed directly on the sub-grade from the hauling equipment except in areas where hand labor must be performed.
- (g) **Vibrators:** Vibrators for full-width vibration of concrete pavements shall be internal vibrators with multiple spuds. They may be attached to the spreader or mounted on a separate carriage operating directly behind the spreader. The frequency of vibrators shall be at least 7,000 impulses per minute. When spud internal vibrators, either hand operated or attached to spreaders, are used adjacent to forms, they shall have a frequency of at least 3,500 impulses per minute. Vibration shall be controlled by the forward movement of the spreader so that vibration automatically ceases when the forward movement of the spreader is stopped.
- (h) **Spraying Equipment:** When liquid membrane-forming compound is used for curing concrete pavement, the Contractor shall provide mechanical spraying equipment mounted

on movable bridges. The equipment shall be the full atomizing type equipped with a tank agitator and a gage to measure the quantity of material applied. The equipment shall be capable of continuously agitating the membrane during application.

- (i) **Concrete Saw:** When sawing joints is elected or specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate with a water-cooled, diamond-edged saw blade or an abrasive wheel.
- (j) **Slip Form Paver:** The paver shall be designed to consolidate, screed, and float finish the freshly placed concrete in one complete pass of the machine and in a manner so that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement. The paver shall be equipped to vibrate the concrete thoroughly for the full width and depth of the strip of pavement being placed.

316.04—Procedures

- (a) **Concrete Base Course:** The sub-grade or sub-base upon which the base course is to be placed shall be prepared in accordance with the requirements of the applicable provisions of these specifications for such course. The construction of a hydraulic cement concrete base course shall conform to the requirements of these specifications except for floating and final finishing of the surface. The surface shall be finished so that there will be no deviation of more than 1/4 inch between any two contact points when tested with a 10-foot straightedge placed parallel to the center line. A heavy broomed texture shall be applied.
- (b) **Preparing Grade:** The sub-grade shall be prepared as specified in Section 305. The course upon which the concrete pavement will rest, including the area that will support the paving equipment, shall be graded and compacted to the required profile. Before or after side forms have been securely set to grade, the sub-grade or sub-base course shall be brought to the proper cross section. The finished grade shall be maintained in a smooth and compacted condition until pavement is placed. The sub-grade or sub-base course shall be uniformly moist when concrete is placed. However, the method of moistening shall not be such as to form mud or pools of water.
- (c) **Placing Reinforcing Steel for Continuously Reinforced Pavement:** At each location where five or more consecutive days will elapse between placement operations, a “leave out” joint shall be installed as detailed on the plans. Longitudinal bars shall be positioned in the finished pavement within $\pm 1/2$ inch of the specified vertical position and ± 1 inch of the specified horizontal position with a cover of at least 2 inches. Pre-bent deformed tie bars, Grade 40 or 60, may be used in the joint between the mainline and ramp pavement to facilitate the use of the slip form paver. Bars shall be pre-bent with equipment designed especially for fabricating 90-degree bends in 5/8-inch deformed bars without damage to the bars. Side forms of the slip form paver shall be designed in a manner so that the pre-bent tie bars can be inserted in an appropriate slot and will pass between the edge of the pavement and the inside face of the trailing forms as the paver advances. When reinforced concrete pavement is placed in two layers, the entire width of the

bottom layer shall be vibrated and struck off to such length and depth that the sheet of fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly on the concrete, after which the top layer of concrete shall be placed, struck off, and screeded. Any portion of the bottom layer of concrete that has been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or placed by approved mechanical or vibratory means in fresh concrete after spreading. Reinforcing steel shall be straight, and its surface condition shall conform to the requirements of Section 406.03(b).

- (d) **Setting Forms:** The foundation under forms shall be compacted to grade so that forms, when set, will be firmly in contact for their entire length and at the specified grade. Any foundation grade that is found to be low shall be filled to grade with granular material in lifts of 1/2 inch or less for a distance of 18 inches on each side of the base of the form and thoroughly compacted. Imperfections or variations above grade shall be corrected by tamping or cutting as necessary. Forms shall be set at least 500 feet in advance of concrete placement. Where local conditions make this requirement impracticable, it may be waived. After the forms have been set, the grade shall be thoroughly tamped at the inside and outside edges of the base of forms. Forms shall be staked into place with a sufficient number of pins of sufficient length for any section to hold the form at the correct line and grade. Form sections shall be tightly locked, free from play or movement. The top of the form, when tested with a 10-foot straightedge, shall not deviate more than 1/8 inch and the longitudinal axis of the vertical face shall not vary more than 1/4 inch from the straightedge. No excessive settlement or springing of forms under the finishing machine will be allowed. Forms shall be cleaned and oiled prior to concrete placement. The alignment and grade elevation of forms shall be checked and corrections made by the Contractor immediately before concrete placement. If any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.
- (e) **Placing Concrete:** Concrete shall be placed on the grade in a quantity that will provide a uniform and adequate supply for the finishing equipment. Spreading shall be accomplished with a mechanical spreader. Necessary hand spreading shall be performed using square-faced shovels. The use of rakes or hoes will not be permitted. Workers shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with soil or foreign substances. Where concrete is placed adjoining a previously constructed lane and mechanical equipment will be operated from the existing lane, the concrete in that lane shall have attained a modulus of rupture strength of at least 450 pounds per square inch. Test specimens for this purpose shall conform to the requirements of AASHTO T23 and shall be tested in accordance with the requirements of AASHTO T177. Equipment that will damage the surface of the existing pavement will not be permitted. Concrete shall be thoroughly consolidated against forms and joint assemblies by means of full-width vibration. Vibrators will not be permitted to come in contact with a joint assembly, reinforcement, or side forms. The vibrator shall not be operated for more than 15 seconds in any one location. When fabric or bar mat reinforcement is placed by mechanical equipment that uses vibration or a tamping action, other vibratory equipment may be eliminated except in areas adjacent to side forms. Concrete shall be placed as close to

expansion and contraction joints as is possible without disturbing the joints. Concrete shall be placed over and around dowels in a manner so that dowels are fully embedded without displacement. Concrete for continuously reinforced pavement shall be placed through the openings in the steel in one lift and vibrated with an internal vibrator for the entire width and depth. Special attention shall be given to the consolidation of the concrete in the immediate vicinity of construction joints and other areas where the performance of vibrators mounted on the paving equipment is questionable. Following concrete placement, concrete shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement will be reasonably close to the elevation shown on the plans or as established by the Engineer. If concrete operations are permitted to extend after sunset, adequate lighting shall be provided.

- (f) **Test Specimens:** The Contractor shall furnish the concrete necessary for casting test beams in accordance with the requirements of (o) herein. Beams shall be cured by a designated method as specified for the pavement in accordance with the requirements of AASHTO T23.

- (g) **Jointed Pavement:** Joints shall be installed in a manner and at such time to prevent random or uncontrolled cracking. If random or uncontrolled cracking occurs, sufficient concrete shall be removed and replaced on each side of the cracking to form a slab at least 10 feet long. Transverse construction joints shall be constructed at each end of the slab in accordance with the requirements of applicable provisions of 4. herein.
 - 1. **Longitudinal joints:** Deformed tie bars of the specified length, size, spacing, and material shall be placed perpendicular to the longitudinal joints. They shall be placed by approved mechanical equipment and rigidly secured by chairs or other approved supports to prevent displacement or by the insertion of bars with an approved hand tool. When adjacent lanes of pavement are constructed separately, approved two-piece connectors shall be used. Longitudinal joints shall be sawed, formed, or created using a strip insert. Longitudinal center joints shall be installed in a manner so that full contact is made at intersections with transverse joints.
 - a. **Formed joints:** Formed joints shall consist of a groove extending downward from, and normal to, the surface of the pavement and shall be formed by an approved nonmetallic or removable device that consistently demonstrates its ability to produce in fresh concrete a joint having the dimensions and line indicated on the plans. The groove shall be sealed with a pre-molded or poured joint material as required.
 - b. **Strip insert joints:** A longitudinal weakened plane joint may be furnished at traffic lane lines in multilane monolithic concrete pavement in lieu of forming or sawing such joints. Strip insert joints shall be formed by placing a continuous strip of plastic or other approved material. The insert strip shall be of sufficient width to form a weakened plane to the depth shown on the plans. The thickness of the insert material shall be at least 20 mils. Strip insert joints shall not be sawed. The insert strip shall be inserted with a mechanical device that places the material in a continuous strip. Splices will be permitted provided they are effective in maintaining the continuity of the insert strip. The top edge of the insert strip shall be positioned flush with the finished surface. The insert strip shall not be

deformed from a vertical position during installation or in subsequent finishing operations performed on the concrete. The alignment of the finished joint shall be uniformly parallel with the center line of the pavement and free from local irregularities in alignment that are more than 1/2 inch in 10 feet. The mechanical installation device shall vibrate the concrete during the insertion of the strip in a manner to cause the disturbed concrete to return evenly along the sides of the strip without segregating or developing voids. If the Contractor is unable to furnish a satisfactory strip insert joint consistently, he shall, upon being notified by the Engineer, discontinue furnishing such joints and furnish other approved formed or sawed joints without additional compensation.

- c. **Sawed joints:** Longitudinal sawed joints shall be cut by approved concrete saws. Suitable guidelines or devices shall be used to ensure cutting the longitudinal joint on the true line as shown as soon as the concrete has hardened sufficiently to permit sawing without chipping, spalling, or tearing. Concrete faces of the saw cut shall be protected from drying until the end of the specified curing period. Sawed joints shall be thoroughly cleaned and dried prior to being sealed.
2. **Transverse expansion joints:** Transverse expansion joints shall be formed in accordance with the requirements of 1.a. herein and shall be sealed using Type D material. Expansion joint filler shall be continuous from form to form, shaped to the sub-grade. Preformed joint filler shall be furnished in lengths equal to the pavement width or the width of one lane. Damaged or repaired joint filler shall not be used. Expansion joint filler shall be held in a position perpendicular to the Sub-grade. An approved installing bar, or other device, shall be used, if required, to secure preformed joint filler at the proper grade and alignment during placing and finishing of concrete. Finished joints shall not deviate more than 1/4 inch in the horizontal alignment from a straight line. If joint filler is assembled in sections, there shall be no offsets between adjacent units.
3. **Transverse contraction joints:** Transverse contraction joints shall consist of planes of weakness created by cutting grooves in the surface of the pavement and, when shown on the plans, shall include load transfer assemblies. Edges of concrete adjacent to the joint may be rounded or beveled to a radius or length approved by the Engineer. Any joint having insufficient opening shall be re-sawed or ground to the proper size. Where a joint opening is larger than that specified, the Contractor may be required to build up the joint with epoxy mortar or to furnish a larger size seal as determined by the Engineer. The cost of any such additional work or material shall be borne by the Contractor.
4. **Transverse construction joints:**
 - a. **Jointed pavement:** Unless specified expansion joints occur at the same points, transverse construction joints shall be constructed at the end of each day's work or when there is an interruption of more than 30 minutes in the concreting operations. A transverse construction joint shall not be constructed within 10 feet of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, the excess concrete back to the last preceding joint shall be removed and disposed of as directed. An approved header board, cut to the required cross section, shall be used to

form joints. Deformed dowel bars shall be used in transverse construction joints whose location does not coincide with the specified location of a transverse expansion or contraction joint.

- b. **Continuously reinforced concrete pavement:** Transverse construction joints shall be formed by the use of an approved header board in accordance with the requirements of 4.a. herein. The header shall consist of two sections, one being placed above and one being placed below the reinforcing mat, and shall be furnished with openings to accommodate the longitudinal steel and additional reinforcement required. At any location where a “leave out” is necessary for a detour, at least 100 feet shall be maintained between transverse construction joints.
 5. **Load transfer devices:** Plain dowels shall be held in position parallel to the surface and centerline of the slab by a metal device that is left in the pavement. The entire free end of each dowel shall be painted with one coat of approved paint. When the paint has dried and immediately before dowels are placed in position, the free end shall be thoroughly coated with an approved lubricant. A metal or plastic dowel cap of approved design to cover 2 inches, $\pm 1/4$ inch, of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 1 inch from the end of the dowel bar shall be furnished for each dowel bar used in expansion joints. Caps or sleeves shall fit the dowel bar tightly, and the closed end shall be mortar tight. Dowels, plastic coated in accordance with the requirements of Federal Specification L-C-530 C or epoxy coated in accordance with the requirements of AASHTO M284, may be used in lieu of painted and lubricated dowel bars. In lieu of using dowel assemblies at contraction joints, dowel bars may be placed in the full thickness of pavement by an approved device
 6. **Isolation joints at structures:** Isolation joints shall be formed by placing a strip of 1/2-inch preformed expansion joint filler around each structure that extends into or through the pavement before concrete is placed at that location.
- (h) **Final Striking Off, Consolidating, and Finishing:** The sequence of operations shall be as follows: (1) striking off, (2) consolidating, (3) floating, (4) removing laitance, (5) straight edging, and (6) finishing. If the application of moisture to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment.
1. **Finishing at joints:** Concrete adjacent to joints shall be mechanically vibrated to prevent voids and segregation from occurring against the joint material, also under and around load transfer devices, joint assembly units, and other features designed to extend into the pavement.
 - a. **Machine finishing:** Concrete shall be spread as soon as placed, struck off, and then screeded by an approved finishing machine. Vibration for the full width of the paving slabs shall be provided in accordance with the requirements of Section 316.03(g). The machine shall be operated over each area of pavement as many times and at such intervals as necessary to result in proper consolidation and develop a surface of uniform texture. Excessive manipulation of a given area shall be avoided. During the first pass of the finishing machine, a uniform roll of concrete shall be maintained ahead of the front screed for its entire length. If a uniform and satisfactory density of concrete is not obtained at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to

- furnish equipment and use methods that will produce pavement conforming to the requirements specified herein.
- b. **Hand finishing:** Hand finishing will be permitted only under the following conditions: (1) to finish concrete already deposited on the grade in the event of a breakdown of mechanical equipment; and (2) to finish narrow widths, approach slabs, or other areas of irregular dimensions where the operation of mechanical equipment is impractical. Concrete shall be struck off as it is placed and screeded with an approved portable screed. If reinforcement is required, the bottom of concrete shall be screeded prior to placement of reinforcement. Consolidation shall be attained by the use of an approved vibrator or other approved equipment. Hand finishing shall be kept to the absolute minimum necessary to attain a surface that has a uniform texture, is true to the approximate grade and cross section, and has a closed surface.
2. **Floating:** After concrete has been struck off and consolidated, it shall be further smoothed and made true by means of a float using one of the following methods as specified or permitted:
 - a. **Mechanical method:** A mechanical float shall be adjusted so that its full length will be in continuous contact with the surface of the pavement. If necessary, long-handled floats having blades at least 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, the prescribed method of floating.
 - b. **Hand method:** This method will be permitted only in those instances specified in 1.b. herein. Following strike off by an approved screed, concrete shall be smoothed with a darby to level raised spots or fill depressions. Long-handled floats or hand floats of wood or metal, as the area dictates, may be used in lieu of darbies to smooth and level the concrete surface. Excessive bleed water shall be wasted over the side forms after each pass of the float.
 3. **Straightedge testing and surface correction:** After floating has been completed and excess water removed, but while concrete is still fresh, the surface of the concrete shall be tested for trueness with a 10-foot straightedge. The Contractor shall furnish and use an accurate 10-foot straightedge swung from handles 3 feet longer than 1/2 the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the pavement center line, and the entire area shall be gone over from one side of the slab to the other as necessary. Advancement along the pavement shall be in successive stages of not more than 1/2 the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, refinished, and retested. High areas shall be cut down and refinished. Special attention shall be given to ensure that the surface across joints conforms to the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straight edge and the slab conforms to the required grade and cross section.
 4. **Final finish (texture):** Prior to grooving, multi-ply damp fabric shall be dragged over the pavement surface to provide a gritty texture on ridges between grooves.

The roadway pavement riding surface shall be textured with (1) uniformly pronounced grooves approximately 1/8 inch in depth and 1/8 inch in width on approximately 3/4-inch centers and transverse to the pavement center line, or (2) a combination of uniformly pronounced grooves approximately 1/8 inch in depth and 1/8 inch in width on approximately 3/4-inch centers and longitudinal to the pavement center line, and additional grooves 1/8 inch in depth and 1/8 inch in width on approximately grooves 1/8 inch in depth and 1/8 inch in width on approximately 3 inch centers and transverse to the pavement center line.

(i) **Stenciling Station Numbers and Dates:** Before concrete takes its final set and after finishing operations are completed, the Contractor shall stencil station numbers and dates into the pavement in accordance with the standard drawings. The dies for numbering and dating will be furnished by and remain the property of the Department. Dies or numerals lost or damaged by the Contractor shall be replaced at his expense.

(j) **Curing:**

1. **Membrane-forming compounds:** The entire surface of the pavement shall be sprayed uniformly with a white pigmented membrane forming compound immediately following the texturing operation. The compound shall be applied under constant pressure at the rate of 100 to 150 square feet per gallon by mechanical sprayers mounted on movable bridges. On textured surfaces, the rate shall be as close to 100 square feet as possible. Application shall be such that an even, continuous membrane is produced on the concrete surface. At the time of use, the compound shall be in a thoroughly mixed condition, with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be continuously and effectively agitated. Hand spraying of odd widths or shapes and concrete surfaces exposed by removing forms and sawing joints will be permitted. The membrane shall harden 30 minutes after application. Personnel and equipment shall be kept off the freshly applied material to prevent damage to the seal. If the membrane becomes damaged within the initial 72 hours, damaged portions shall be repaired immediately with additional compound. Upon removal of side forms, sides of exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface. If the slip form method of paving is used, edges of pavement shall be cured in the same manner and at the same time as the surface.
2. **PE film:** When PE film is used for curing, it shall be white. However, from November 1 to April 1, clear or opaque PE film will be permitted.
3. **Protection in cold weather:** The Contractor shall prevent the temperature at the surface of the concrete from falling below 40 degrees F during the first 72 hours immediately following concrete placement. Protective material shall be left in place for an additional 48 hours if freezing air temperatures are expected to continue. Such protection shall be furnished in addition to the curing material required elsewhere in these specifications. The Contractor shall be responsible for the quality of the concrete placed during cold weather. Concrete damaged by the action of frost or by freezing shall be removed and replaced at the Contractor's expense.
4. **Curing in hot, low-humidity, or windy weather:** Care shall be taken in hot, dry, or windy weather to protect the concrete from shrinkage cracking by applying the

curing medium at the earliest possible time after finishing operations and after the sheen has disappeared from the surface of the pavement.

- (k) **Surface Test:** As soon as concrete has hardened sufficiently, the pavement surface will be tested by the Engineer with a 10-foot straightedge. Areas showing high spots of more than 3/16 inch on mainline pavement and approach slabs but not exceeding 1/2 inch in 10 feet shall be marked and, after the concrete has attained the design compressive strength, cut down with an approved cutting tool to an elevation where the area or spot will not show surface deviations in excess of 3/16 inch. Areas showing high spots of more than 3/8 inch on ramps when tested with a 10-foot straightedge shall be marked and, after the concrete has attained the design compressive strength, corrected to within the 3/8-inch tolerance by removing and replacing or by cutting as specified herein. If the slip form method of paving is used, a straightedge tolerance of $\pm 1/4$ inch in 10 feet will be permitted for the area within 6 inches of the slip formed edge except for pavement adjacent to connections and ramps. Equipment for cutting shall be designed to cut the surface of the pavement in a longitudinal direction parallel to the centerline and in a uniform planing action. However, the cutting operation shall not produce a polished pavement surface. The equipment shall be adjustable so as to vary the depth of the cut as required. Bush hammering, rubbing with carborundum stone, or hand grinding will not be permitted. Where the departure from correct cross section exceeds 1/2 inch on mainline pavement, the pavement shall be removed and replaced by and at the expense of the Contractor.
- (l) **Removing Forms:** Forms shall not be removed from freshly placed concrete until it has set for at least 12 hours. Forms shall be removed carefully to avoid damage to the pavement. After forms are removed, the sides of the slab shall be cured as specified by one of the methods described herein. Major honeycombed areas will be considered defective work and shall be removed and replaced. Any area of section removed shall be not less than 10 feet in length or less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.
- (m) **Sealing Joints:** Before pavement is opened to traffic, including the Contractor's equipment, and as soon after completion of the curing period as practicable, joints required to be sealed shall be filled with joint-sealing material. Just prior to sealing or resealing, each joint shall be thoroughly cleaned by brushing, routing, sawing, grinding, blast cleaning, or any combination thereof to eliminate oil, grease, existing joint material, membrane-forming compound, laitance, protrusions or hardened concrete, dirt, or other foreign material that cannot be removed by means of compressed air to a depth at which the sealer and backup material, if required, are to be installed. Dust and loose material shall be removed from the joint with oil-free and water-free compressed air delivered at a minimum of 120 cubic feet of air per minute and a nozzle pressure of at least 90 pounds per square inch. Existing joint material extending outside the joint shall be removed. Joint material shall be installed in accordance with the manufacturer's recommendations. However, in the absence of specific recommendations or plan details, the following provisions shall apply.
1. Pre-formed seals shall be installed by machines that are designed especially for such installation and shall not damage the seal. Types A and D material shall be

installed by machine. The seal shall be installed with its vertical axis parallel to the interfaces of the joint.

2. The method of installing preformed seals shall be such that the seal is not stretched more than 5 percent of the length of the joint. The method of installation shall be checked for stretching, using transverse joint sealer. The check shall consist of installing sealer in five joints, the full width of the pavement, and removing the sealer immediately after installation and checking the length. If the measured length of any of the five sealers is less than 95 percent of the minimum theoretical length required to seal the joint, the installation method shall be modified so that stretching greater than 5 percent no longer occurs. Once sealing operations have started, 1 joint per every 100 shall be removed and checked for stretch in excess of 5 percent. If a stretched condition is detected, the joint sealers on either side shall be removed until the condition disappears. Affected joints shall be resealed in a satisfactory manner at the Contractor's expense.
3. For rounded or beveled joints, seal or sealant shall be installed in a depth of at least 1/8 but not more than 1/4 inch below the bottom edge of the rounding or bevel. For joints with vertical sides, seals or sealant shall be installed at a depth of 1/4 inch, $\pm 1/16$ inch, below the level of the pavement surface.
4. Hot-poured sealer shall be applied to a completely dry joint. The ambient air temperature shall not be below 40 degrees F. The joint shall be filled with hot-poured sealer by means of a sealing device that will not cause air to be entrapped in the joint. Sufficient passes shall be made to achieve the filled joint requirement.
5. Material for hot-poured sealer shall be stirred during heating so that localized overheating does not occur.
6. Sealer shall not be placed directly on the filler but shall be prevented from bonding to the filler by a carefully placed strip of waxed or silicone paper, plastic tape, aluminum foil, or other suitable material placed over the filler before sealer is applied. Masking tape or other means shall be used to avoid spilling sealer onto adjacent concrete surfaces. Excess sealer on such surfaces shall be cleaned off before the material has set without damaging the material in the joint.
7. Silicone sealer shall not be applied when the air temperature is below 40 degrees F. Sealer shall fill the joint and shall be applied inside the joint from the bottom up by means of an application device that will not cause air to be entrapped. Immediately after application, sealer shall be tooled to form a recess below the pavement surface in accordance with the standard drawings. The use of soap, water, or oil as a tooling aid will not be permitted. Primer, if used with silicone sealer, shall be applied to the joint faces prior to installation of backup material. Backup material shall be approximately 25 percent larger than the joint width and shall be installed in the joint such that it is not displaced during the sealing application. Sealing material shall be applied in a manner so that it will not be spilled on the exposed surfaces of the concrete. Excess material on the surface of the concrete pavement shall be removed immediately, and the pavement surface cleaned. The use of sand or similar material as a cover for the seal will not be permitted.

- (n) **Protecting Pavement:** The Contractor shall protect the pavement and its appurtenances against public traffic and traffic caused by his employees and agents. This shall include furnishing watchpersons and flaggers to direct traffic and erecting and maintaining

warning signs, lights, pavement bridges, or crossovers. In order that the concrete may be properly protected against the effects of rain before it has attained final set, the Contractor shall have covering material available at the work site, such as burlap, cotton mats, curing paper, or plastic sheeting. If the slip form method of paving is used, the Contractor shall also have material available at all times for protecting the edges of unhardened concrete. Protective materials shall consist of standard metal forms or wood planks having a nominal thickness of at least 2 inches and a nominal width of at least the thickness of the pavement at its edges. When rain appears imminent, concrete placement operations shall be halted and available personnel shall assist in covering the surface of unhardened concrete. A layer of coarse burlap shall be applied to the surface of fresh concrete prior to the application of PE film or other protective coverings that tend to “wipe out” or reduce the texture upon contact. The Engineer will carefully consider any damage to the pavement occurring prior to final acceptance and may allow the Contractor to repair such damage or require the damaged pavement to be replaced.

- (o) **Opening to Traffic:** Pavement shall not be opened to traffic until specimen beams conforming to the requirements of (f) herein have attained a modulus of rupture strength of 600 pounds per square inch when tested by the center point loading method in accordance with the requirements of AASHTO T177. In the absence of such tests, pavement shall not be opened to traffic until 14 days after concrete is placed. Prior to opening to traffic, pavement shall be cleaned and joints sealed and trimmed.

316.05—Tolerances

The thickness of pavement will be determined by average caliper measurements of cores taken there from, as described in VTM-26. Areas found to be deficient in thickness by more than 1.00 inch will be evaluated by the Engineer, and if in his judgment the deficient areas warrant removal, they shall be removed and replaced with concrete of the thickness specified on the plans. The deficient area shall be the product of the full width of the slab or lane of pavement multiplied by the sum of the distances in each direction from the deficient core along the center line of the pavement to the first actual cores found not deficient in thickness by more than 1.00 inch. The Contractor shall fill test holes with the same type of concrete as in the pavement.

**VDOT SECTION 508
DEMOLITION OF PAVEMENT AND OBSCURING ROADWAY**

508.01—Description.

This work shall consist of demolition of pavement and obscuring roadway to restore areas that are no longer needed for highway use in accordance with these specifications and in reasonably close conformity to the lines and contours shown on the plans or as established by the Engineer.

508.02—Procedures.

(a) Demolition of Pavement Structures:

1. **Hydraulic cement concrete pavement** shall be demolished as follows:
 - a. **Pavement** shall be broken into pieces and either used in fill areas as rock embankment in accordance with the requirements of Section 303 or disposed of at locations selected by the Contractor and approved by the Engineer; *or*
 - b. **Material within the proposed roadway prism and more than 3 feet below the subgrade** may be broken into pieces not more than 18 inches in any dimension, sufficiently displaced to allow for adequate drainage, and left in the roadway prism.
2. **Asphalt concrete pavement** that does not overlay or underlie hydraulic cement concrete pavement shall be removed as follows:
 - a. **Pavement** shall be removed and used in the work as designated on the plans or as directed by the Engineer; *or*
 - b. When approved by the Engineer, pavement shall be removed and disposed of at locations selected by the Contractor.
3. **Cement stabilized courses underlying pavement** designated for demolition shall be disposed of in accordance with (a)1.a. or (a)1.b. herein.
4. **Aggregate underlying pavement designated for demolition**, except hydraulic cement concrete pavement disposed of in accordance with (a)1.b. herein, shall be salvaged and used for maintenance of traffic or, when approved by the Engineer, disposed of in accordance with (a)2.a. herein.

(b) Obscuring Roadway:

1. **Areas outside construction limits consisting of asphalt concrete or hydraulic cement concrete pavement** demolished in accordance with (a) herein shall be conditioned in accordance with the following:

- a. Tops of slopes that do not contain rock shall be rounded for a distance of not more than 10 but not less than 5 feet (where sufficient right of way exists) beyond the point of intersection of the existing slope and the natural ground surface. The depth of the rounding shall be not more than 2 feet below the original surface of slopes.
 - b. Disturbed areas that are to receive vegetation shall be scarified or plowed, harrowed, and shaped.
 - c. Clearing and grubbing shall be performed in accordance with the requirements of Section 301.
2. **Areas outside construction limits consisting of pavement structures, other than asphalt concrete or hydraulic cement concrete**, that are designated for obscuring roadway shall be conditioned in accordance with (b)1. herein. Prior to the obscuring, pavement structures shall be removed in accordance with the applicable requirements of (a) herein.