

APPENDIX B

VIRGINIA ROAD & BRIDGE SPECIFICATIONS

SECTION 101--DEFINITIONS OF ABBREVIATIONS, ACRONYMS, AND TERMS

101.01--Abbreviations and Acronyms.

In these specifications and in other contract documents, the following abbreviations and acronyms shall be interpreted as follows:

AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ABS	Acrylonitrilebutadienestyrene (an elastomer)
AC	Alternating current
ACI	American Concrete Institute
ADT	Annual average daily traffic
AED	Associated Equipment Distributors
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute; American Pipe Institute
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American wire gage
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials and Code Administrators
CBR	California bearing ratio
CRSI	Concrete Reinforcing Steel Institute
DBE	Disadvantaged Business Enterprise
DC	Direct current
DHV	Design hourly volume
EI	Edison Electric Institute
EEO	Equal employment opportunity
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
EPDM	Ethylenepropylenedienemonomer (an elastomer)
F/A	Filler/asphalt ratio
FHWA	Federal Highway Administration
FS	Federal Specifications, General Services Administration

ICEA	Insulated Cable Engineers Association
IMSA	International Municipal Signal Association
ITE	Institute of Transportation Engineers
LCD	Liquid crystal display
LPG	Liquid petroleum gas
MBE	Minority Business Enterprise
MEKP	Methyl ethyl ketone peroxide
MIL	Military specifications
MSDS	Materials Safety Data Sheet
MUTCD	<i>Manual on Uniform Traffic Control Devices for Streets and Highways</i> and the Virginia supplement to same
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
PCI	Prestressed Concrete Institute
PE	Polyethylene
PTL	Plywood Testing Laboratory
PVC	Polyvinylchloride
PVF	Polyvinylfluoride
REA	Rural Electrification Administration
SAE	Society of Automotive Engineers
SI	The International System of Units
SPIB	Southern Pine Inspection Bureau
SSPC	Steel Structures Painting Council
TAPPI	Technical Association of Pulp and Paper Industry
TFE	Polytetrafluoroethylene
UL	Underwriters' Laboratories, Inc.
VAC	Volts alternating current
VDC	Volts direct current
VDOT	Virginia Department of Transportation
VEP	Value engineering proposal
VFA	Voids filled with asphalt
VMA	Voids in mineral aggregate
VOSH	Virginia Occupational and Health Administration
VTM	Virginia test methods; voids in total mix
WBE	Women Business Enterprise

101.02--Terms.

In these specifications and in other contract documents, the following terms and pronouns used in place of them shall be interpreted as follows:

- A -

Advertisement, Notice of. A public announcement, as required by law, inviting bids for work to be performed or materials to be furnished that indicates approximate principal quantities, location of work to be performed, character and quantity of materials to be furnished, and time and place for opening bids.

Alkali soil. Soil in which total alkali chlorides calculated as sodium chloride are more than 0.10 percent based on total solids.

Award. The decision of the Board to accept the bid of the lowest responsive and responsible bidder for the work. The award is subject to the execution and approval of a satisfactory Contract therefor, and such conditions as may be specified or required by law.

Award date. The date on which the decision is made by the Board to accept the bid of the lowest responsive and responsible bidder.

- B -

Backfill. Material used to replace or the act of replacing material removed during construction; may also denote material placed or the act of placing material adjacent to structures.

Balance point. The approximate point, based on estimated shrinkage or swell, where the quantity of earthwork excavation and borrow, if required, is equal to the quantity of embankment material plus any surplus excavation material.

Base course. A layer of material of specified thickness on which the intermediate or surface course is placed.

Base flood. The flood or tide having a one percent chance of being exceeded in any given year.

Bid. The offer of a bidder, submitted on the proposal, to perform the work and furnish the materials and labor at the prices set forth therein; valid only when properly signed and guaranteed.

Bidder. Any individual, partnership, corporation, or joint venture that formally submits a bid for the work contemplated, or for any portion thereof, acting directly or through a duly authorized representative.

Bids, Invitation for. See **Advertisement, Notice of.**

Board. Commonwealth Transportation Board of Virginia.

Borrow. Suitable material from sources outside the roadway that is used primarily for embankments.

Brackish water. Water in which total alkali chlorides calculated as sodium chloride are more than 0.10 percent based on total solids.

Bridge. A structure, including supports, that is erected over a depression or an obstruction, such as water, a highway, or a railway, that has a track or passageway for carrying traffic.

- C -

Calendar day. Any day shown on the calendar.

Camber. A vertical curvature induced or fabricated into beams or girders and a deck slab or slab span formwork; a vertical curvature set in the grade line of a pipe culvert to accommodate differential settlement.

Channel. A water course or drainage way.

Commissioner. Commonwealth Transportation Commissioner.

Composite hydrograph. A graph showing the mean daily discharge versus the calendar day, indicating trends in high and low flow for a one year period.

Construction area. The area where authorized construction occurs.

Construction limits. The intersection of side slopes, including slope rounding, with the original ground, plus slopes for drainage ditches or incidental construction.

Contract. The written agreement executed between the Department and the Contractor that sets forth the obligations of the parties thereunder, including, but not limited to, the performance of the work, furnishing of materials and labor, and basis of payment. The Contract also includes these specifications; supplemental specifications; special provisions; special provision copied notes; plans; standard drawings; change orders; and work orders and agreements that are required to complete the construction of the specified work in an acceptable manner, including authorized extensions thereof, all of which constitute one instrument. Oral representations or promises shall not be considered a part of the Contract.

Contract Engineer. The Engineer's authorized representative for administering the advertisement, receiving bids, and awarding contracts for the Department.

Contract item. A specifically described unit of work for which a price is provided in the Contract.

Contract time limit. The number of calendar days or calendar date that specifies the time allowed for completion of the work described in the Contract, including authorized extensions.

Contractor. Any individual, partnership, corporation, or joint venture that contracts with the Department to perform the prescribed work.

Cul-de-sac. An area at the terminus of a dead-end street or road that is constructed for the purpose of allowing vehicles to turn around.

Culvert. A structure that is not classified as a bridge which provides an opening under any roadway.

Cut. The portion of a roadway formed by excavating below the surface of the earth.

- D -

Day. Unless otherwise stated, a calendar day.

Deflection. The vertical movement occurring between the supports of a bridge superstructure or its components (beams, girders, and slabs) that results from their own weight and from dead and live loads. Although all parts of a structure are subject to deflections, usually only those deflections that occur in the superstructure are of significance during construction.

Department. Virginia Department of Transportation.

Deputy Commissioner. The assistant to the Commissioner who performs such of the Commissioner's duties as have been delegated to him by the Commissioner.

Design flood. The magnitude of flood that a given structure can convey without exceeding a designated flood level.

Disincentive. A monetary deterrent used to discourage the Contractor from exceeding the contract time limit.

Disposable material. Material generally found to be unsuitable for roadway construction or material that is surplus.

Disposal areas. Areas generally located off the project right of way where unsuitable or surplus material is deposited.

Drainage ditch. An artificial depression constructed to carry off surface water.

- E -

Earthwork. The work consisting of grubbing, drainage, roadway excavation, embankment excavation, borrowing, grading, placing rock, and preparing subgrades.

Easement (Right of way). A grant of the right to use property for a specific use.

Embankment. A structure of soil, soil aggregate, or broken rock between the existing ground and subgrade.

Employee. Any person working on the project specified in the Contract who is under the direction or control of or receives compensation from the Contractor or subcontractor.

Engineer. The Chief Engineer, who acts directly or through his duly authorized representative. The representative acts within the scope of the particular duties assigned to him or the authority given to him.

Equipment. Machinery, tools, and other apparatus, together with the necessary supplies for upkeep and maintenance, that are necessary for acceptable completion of the work.

Extra work. An item of work that is not provided for in the Contract as awarded but that is found to be essential to the satisfactory fulfillment of the Contract within its intended scope.

- F -

Falsework. A framework of wood or steel used to support forms for the construction of concrete slab spans or t-beams, or provide temporary support for structural units during the construction or reconstruction of permanent supports.

Federal agencies or officers. An agency or officer of the federal government and any agency or officer succeeding in accordance with the law to the powers, duties, jurisdictions, and authority of the agency or officer mentioned.

Flood frequency. A statistical average recurrence interval of floods of a given magnitude.

Force account work. Prescribed work of a contractual status performed by the Contractor and compensated for as specified in Section 109.05.

Formwork. A temporary structure or mold used to retain the plastic or fluid concrete in its designated shape until it hardens. Formwork shall be designed to resist the fluid pressure exerted by plastic concrete and additional fluid pressure generated by vibration and temporary construction loads.

Frontage street or road. A local street or road auxiliary to and located on the side of a highway for service to abutting property and adjacent areas and control of access.

- G -

Gage. U.S. Standard Gage.

Grade separation. Any structure that provides a traveled way over or under another traveled way or stream.

- H -

Highway. The entire right of way reserved for use in constructing or maintaining the roadway and its appurtenances.

Historical flood level. The highest flood level that is known to have occurred at a given location.

Holidays. The days specifically set forth in Section 105.09.

Hydrologic data sheet. A tabulation of hydrologic data for facilities conveying a 100 year discharge equal to or greater than 14.15 cubic meters per second.

- I -

Incentive. A monetary amount used to encourage the Contractor to complete work prior to the time limit specified in the Contract.

Inspector. The Engineer's authorized representative who is assigned to make detailed inspections of the quality and quantity of the work and its conformance to the provisions of the Contract.

Invert. The lowest point in the internal cross section of a pipe or other drainage structure.

- J -

Joint venture. Two or more individuals, partnerships, corporations, or combinations thereof that join together for the purpose of bidding on and constructing a project.

- L -

Laboratory. The testing laboratory of the Department or any other testing laboratory that may be designated by the Engineer.

Liquidated damages. Compensatory damages as set forth in the Contract, paid by the Contractor to the Department when the Contractor fails to complete the project within the time frame specified in the Contract. These damages include, but are not limited to, additional costs associated with administration, engineering, supervision and inspection of the project.

- M -

Material. Any substance that is used in the work specified in the Contract.

Median. The portion of a divided highway that separates the traveled ways.

- N -

Notice to Proceed. A written notice to the Contractor that advises him of the date on which prosecution of the work shall begin.

- O -

Ordinary high water. A water elevation based on analysis of all daily high waters that will be exceeded approximately 25 percent of the time during any 12 month period.

Overtopping flood. The magnitude of flood that just overflows the traveled way at a given structure and/or on the approach traveled way of such structure.

- P -

Pavement structure. The combination of subbase, base, and surface courses that is placed on a subgrade to support the traffic load and distribute it to the roadbed.

Pay item. A specifically described unit of work for which a price is provided in the Contract.

Phase inspection. The inspection of work at predetermined stages in lieu of continuous inspection.

Plans. The approved plans and standard drawings, profiles, typical cross sections, computer output listings, supplemental drawings or exact reproductions thereof, and all subsequent approved revisions thereto that show the location, character, dimensions, and details of the work specified in the Contract.

Prequalification. The procedure used to assure the Department of the Contractor's ability to perform the work, experience in similar work, and sufficiency of equipment to accomplish the work and that the Contractor's financial resources will permit financing the work.

Profile grade. The line of a vertical plane intersecting the top surface of the proposed wearing surface, usually along the longitudinal center line of the roadbed.

Project. The work specified to be performed in the Contract.

Project showing. The scheduled event at which the Department's representative meets with prospective bidders to describe and answer questions regarding the proposed work.

Proposal. The document sent by the Department to prospective bidders that describes the work for which bids will be accepted; includes the official form on which the Department requires bids to be submitted for the work described.

- R -

Ramp. A connecting roadway between two highways or traveled ways or between two intersecting highways at a grade separation.

Right of way. A general term denoting land, property, or interest therein, usually in a strip, that is acquired for or devoted to transportation facilities but is not meant to denote the legal nature of ownership.

Road. A general term denoting a public way for purposes of vehicular travel including the entire area within the right of way; the entire area reserved for use in constructing or maintaining the roadway and its appurtenances.

Roadbed. The graded portion of a highway within the top and side slopes that is prepared as a foundation for the pavement structure and shoulders.

Roadbed material. The material below the subgrade in cuts, embankments, and embankment foundations that extends to a depth which affects the support of the pavement structure.

Roadside. A general term that denotes the area within the right of way that adjoins the outer edges of the roadway; extensive areas between the roadways of a divided highway.

Roadside development. Items that are necessary to complete a highway that provide for the preservation of landscape materials and features; rehabilitation and protection against erosion of areas disturbed by construction through placing seed, sod, mulch, and other ground covers; and such suitable plantings and other improvements as may increase the effectiveness and enhance the appearance of the highway.

Roadway. The portion of a highway within the limits of construction and all structures, ditches, channels, and waterways that are necessary for the correct drainage thereof.

- S -

Sea water. Water in which total alkali chlorides calculated as sodium chloride are more than 0.10 percent of total solids.

Select borrow. Borrow material that has specified physical characteristics.

Select material. Material obtained from roadway cuts, borrow areas, or commercial sources that is designated or reserved for use as a foundation for the subbase, subbase material, shoulder surfacing, or other specified purposes.

Shoulder. The portion of the roadway contiguous with the traveled way that is for the accommodation of stopped vehicles, emergency use, and lateral support of the base and surface courses.

Sidewalk. The portion of the roadway constructed primarily for the use of pedestrians.

Skew. The acute angle formed by the intersection of a line normal to the center line of the roadway with a line parallel to the face of the abutments or, in the case of culverts, with the center line of the culverts.

Special provision. A document that sets forth specifications or requirements for a particular project.

Special provision copied note. A document that sets forth specifications or requirements, usually limited in scope, for a particular project.

Specialty item. An item of work designated as “Specialty Item” in the proposal that is limited to work which requires highly specialized knowledge, craftsmanship, or equipment that is not ordinarily available in contracting organizations prequalified to bid and is usually limited to minor components of the overall Contract.

Specifications. A general term that includes all directions, provisions, and requirements contained herein and those that may be added or adopted as supplemental specifications, special provisions, or special provision copied notes. All are necessary for the proper fulfillment of the Contract.

Standard drawings. Unless otherwise specified, applicable drawings in VDOT’s *Road and Bridge Standards* and such other standard drawings as are referred to on the plans.

State. Commonwealth of Virginia.

Station. When used as a definition or term of measurement, 100 meters.

Street. A general term denoting a public way for purposes of vehicular travel including the entire area within the right of way; the entire right of way reserved for use in constructing or maintaining the roadway and its appurtenances.

Structures. Bridges, culverts, catch basins, inlets, retaining walls, cribs, manholes, end walls, buildings, steps, fences, sewers, service pipes, underdrains, foundation drains, and other features that may be encountered in the work and are not otherwise classed herein.

Subbase. A layer(s) of specified or selected material of designed thickness that is placed on a subgrade to support a base course.

Subcontractor. Any individual, partnership, corporation, or joint venture to whom the Contractor, with the written consent of the Department, subcontracts part of the Contract.

Subgrade. The top surface of a roadbed shaped to conform to the typical section on which the pavement structure and shoulders are constructed.

Subgrade stabilization. The modification of roadbed soils by admixing with stabilizing or chemical agents that will increase the load bearing capacity, firmness, and resistance to weathering or displacement.

Substructure. The part of a structure that is below the bearings of simple and continuous spans, skewbacks of arches, and tops of footings of rigid frames, together with the back walls, wingwalls, and wing protection railings.

Superintendent. The executive representative of the Contractor who is authorized to receive and fulfill instructions from the Engineer and who supervises and directs the construction.

Superstructure. The portion of a structure that is not defined as substructure.

Supplemental specifications. Additions and revisions to these specifications that are adopted after the issuance of the printed book.

Surety. A corporate entity bound with and for the Contractor for full and complete fulfillment of the Contract and for payment of debts pertaining to the work. When applied to the proposal guaranty, it refers to the corporate body that engages to be responsible in the execution by the bidder, within the specified time, of a satisfactory Contract and the furnishing of an acceptable payment and contract bond.

Surface course. One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and disintegrating effects of weather. The top layer is sometimes called the wearing course.

Surplus material. Material that is present on a project as a result of unbalanced earthwork quantities, excessive swell, slides, undercutting, or other conditions beyond the control of the Contractor.

Suspension. A written notice issued by the Engineer to the Contractor that orders the work on a project to be stopped wholly or in part as specified. The notice will include the reason for the suspension.

- T -

Temporary structure. Any structure that is required to maintain traffic while permanent structures or parts of structures specified in the Contract are constructed or reconstructed. The temporary structure shall include earth approaches.

Ton. A short ton; 2,000 pounds avoirdupois.

Top of earthwork. The uppermost surface of the embankment excavation, exclusive of select material, that is shaped to conform with the typical section.

Traveled way. The portion of the roadway for the movement of vehicles, exclusive of shoulders.

- V -

Vouchered. The action of approval by the Department; constitutes the date of release to the State Comptroller for payment.

- W -

Wearing course. See **Surface course**.

Work. The furnishing of all materials, labor, tools, equipment, and incidentals necessary or convenient for the successful completion of the project and the carrying out of the duties and obligations specified in the Contract.

Working drawings. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data the Contractor is required to submit to the Engineer for review.

Work order. A written order issued by the Engineer to the Contractor that specifies changes in the plans or quantities or both within the scope of the Contract and that establishes the basis of payment and time adjustments for the work affected by the changes.

SECTION 109--MEASUREMENT AND PAYMENT

109.01--Measurement of Quantities.

Work specified in the Contract will be measured by the Engineer according to U.S. Standard Measure. The methods of measurement and computations to be used to determine quantities of material furnished and work performed will be those generally recognized as conforming to good engineering practice.

Longitudinal measurements for surface computations will be made horizontally, and transverse measurements will be the surface measure shown on the plans or ordered in writing by the Engineer. Individual fixture areas of 9 square feet or less will not be deducted from surface areas measured for payment.

Structures will be measured according to neat lines shown on the plans.

Items that are measured by the linear foot will be measured parallel to the base or foundation upon which they are placed.

Allowance will not be made for surfaces placed over a greater area than shown on the plans or for any material moved from outside the area of the cross section and lines shown on the plans.

When standard manufactured items are specified and are identified by weights or dimensions, such identification will be considered nominal. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

- (a) **Measurement by Weight:** Materials that are measured or proportioned by weight shall be weighed on accurate scales. When material is paid for on a tonnage basis, personnel performing the weighing shall be certified by the Engineer and shall be bonded to the Commonwealth of Virginia in the amount of \$10,000 for the faithful observance and performance of the duties of the weighperson required herein. The bond shall be executed on a form having the exact wording as the Weighpersons Surety Bond Form furnished by the Department and shall be submitted to the Department prior to the furnishing of the tonnage material. No payment will be made for materials delivered in excess of the legal load limits established for each truck.

The Contractor shall have the weighperson perform the following:

1. Post and furnish a weekly tare weight of each truck used and keep a record of them for 12 months.
2. Furnish a signed weigh ticket for each load that shows the date, truck number, load number, plant name, size and type of material, project, schedule or purchase order number, and the weights specified herein.
3. Maintain sufficient documentation so that the accumulative tonnage and distribution of each lot of material, by contract, can be readily identified.
4. Submit by the end of the next working day a summary of the number of loads and total weights for each type of material by contract.

Trucks used to haul material being paid for by weight shall display the truck uniform identification number and legal gross and legal net weight limits. These markings shall be no less than 2 inches high and permanently stenciled on each side of the truck with contrasting color and located as to be clearly visible when the vehicle is positioned on the scales and observed from normal position of the weighperson at the scale house.

Trucks used to haul material shall be equipped with a cover suitable to protect the material and to protect the traveling public.

The truck tare to be used in the weighing operation shall be the weight of the empty truck determined with full tank(s) of fuel and the operator seated in the cab. The tare weight of trucks shall be recorded to the nearest 20 pounds. At the option of the Contractor, a new tare may be determined for each load. When a new tare is obtained for each load, the requirement for full tank(s) of fuel will be waived.

Net rail shipment weights may be used for pay quantities when evidenced by railroad bills of lading. However, such weights will not be accepted for pay quantities of materials that subsequently pass through a stationary mixing plant.

Scales shall conform to the requirements for accuracy and sensitivity as set forth by the *National Institute of Standards and Technology Handbook No. 44 for Specification Tolerances and Requirements for Commercial and Weighing Devices*. Scales used in the weighing of materials paid for on a tonnage basis shall be approved and sealed in accordance with the requirements of the policies of the Bureau of Weights and Measures of the Department of Agriculture and Consumer Services, or other approved agencies, at least once every six months and upon being moved. Hopper and truck scales shall be serviced and tested by a scale service representative at least once every six months. Hopper scales shall be checked with a minimum 500 pounds of test weights and truck scales shall be checked with a minimum 20,000 pounds of test weights.

Copies of scale test reports shall be maintained on file at the scale location for at least 18 months, and copies of all scale service representative test reports shall be forwarded to the Department.

The quantity of materials paid for on a tonnage basis shall be determined on scales equipped with an automatic printer. Truck scale printers shall print the net weight and either the gross or tare weight of each load. Hopper scale printers shall conform to the requirements of Section 211.11 and shall print the net weight of each load. The weigh ticket shall also show the legal gross weight for material weighed on truck scales and the legal net weight for material weighed on hopper scales.

If the automatic printer becomes inoperative, the weighing operation may continue for 48 hours provided satisfactory visual verification of weights can be made. The written permission of the Engineer will be required for the operation of scales after 48 hours.

If significant discrepancies are discovered in the printed weight, the ultimate weight for payment will be calculated on volume measurements of the materials in place and unit weights determined by the Engineer or by other methods deemed appropriate to protect the interests of the State.

(b) **Measurement by Cubic Yard:** Material that is measured by the cubic yard, loose measurement or vehicular measurement, shall be hauled in approved vehicles and measured therein at the point of delivery. Material measured in vehicles, except streambed gravel, will be allowed at the rate of 2/3 the volume of the vehicle. The full volume of the vehicle will be allowed for streambed gravel. Such vehicles may be of any size or type acceptable to the Engineer provided the body is of such shape that the actual contents can be readily and accurately determined. Unless all approved vehicles are of uniform capacity, each vehicle shall bear a plainly legible identification mark indicating the specific approved capacity. Each vehicle shall be loaded to at least its water level capacity.

When approved by the Engineer in writing, material specified to be measured by the cubic yard may be weighed and such weights converted to cubic yards for payment purposes. Factors for conversion from weight to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before they are used.

(c) **Measurement by Lump Sum:** When used as an item of payment, the term *lump sum* will mean full payment for completion of work described in the Contract. When a complete structure or structural unit (in effect, lump sum work) is specified as the unit of measurement, the unit will be construed to include necessary fittings and accessories. The quantities may be shown on the plans for items for which lump sum is the method of measurement. If shown, the quantities are approximate and are shown for estimating purposes only. Items that are to be measured as complete units will be counted by the Inspector in the presence of a representative of the Contractor.

(d) **Specific Items:**

1. **Concrete:** Concrete will be measured and computed by dividing the work into simple geometrical figures and adding their volumes.
2. **Excavation, embankment, and borrow:** In computing volumes of excavation, embankment, and borrow, methods having general acceptance in the engineering profession will be used. When the measurement is based on the cross-sectional area, the average end area method will be used.
3. **Asphalt:** Asphalt will be measured by the gallon, volumetric measurement, based on a temperature of 60°F using the following correction factors:
 - a. 0.00035 per degree Fahrenheit for petroleum oils having a specific gravity 60/60°F above 0.966
 - b. 0.00040 per degree Fahrenheit for petroleum oils having a specific gravity 60/60°F between 0.850 and 0.966
 - c. 0.00025 per degree Fahrenheit for emulsified asphalt

Unless volume correction tables are available, the following formula shall be used in computing the volume of asphalt at temperatures other than 60°F:

$$V^1 = V/K(T - 60) + 1$$

where V = volume of asphalt to be corrected; V^1 = volume of asphalt at 60°F; K = correction factor (coefficient of expansion); and T = temperature in degrees Fahrenheit of asphalt to be corrected.

When asphalt is delivered by weight, the volume at 60°F will be determined by dividing the net weight by the weight per gallon at 60°F.

When specified in the Contract, asphalt will be measured by weight. Net certified scale weights, or weights based on certified volumes in the case of rail shipments, will be used as a basis of measurement, subject to correction when asphalt has been lost from the car or the distributor, disposed of, or otherwise not incorporated in the work.

When asphalt is shipped by truck or transport, net certified weights or volumes subjected to correction for loss or foaming may be used to compute quantities.

Only the quantity of asphalt actually placed in the work and accepted will be considered in determining the amount due the Contractor.

4. **Timber:** Timber will be measured in units of 1,000 foot-board-measure actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.
5. **Equipment rental:** Equipment rental will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the project or source of supply and the project except when another method of measurement is specified.

SECTION 202--FINE AGGREGATE

202.01--Description.

These specifications cover material for use as fine aggregate in hydraulic cement concrete, mortar, asphalt concrete, and asphalt surface treatments.

202.02--Materials.

Fine aggregate is classified herein in accordance with its occurrence or method of manufacture as natural sand or stone sand. Natural sand shall consist of grains of hard, sound material, predominantly quartz, occurring in natural deposits or in loosely bound deposits, such as sandstone conglomerate. Stone sand shall consist of sound crushed particles of approved Grade A stone, essentially free from flat or elongated pieces, with sharp edges and corners removed.

Fine aggregates for use in hydraulic cement concrete that are obtained from more than one source shall not be used alternately or mixed without the consent of the Engineer.

202.03--Detail Requirements.

- (a) **Grading:** Grading shall conform to the requirements of Table II-1. Tests will be performed in accordance with the requirements of AASHTO T27.
- (b) **Soundness:** Soundness shall conform to the requirements of Table II-2. Tests will be performed in accordance with the requirements of AASHTO T103 or T104.

TABLE II-1
Fine Aggregate

Amounts Finer Than Each Laboratory Sieve (Square Openings) (% by Mass)								
Grading	3/8 inch (9.5 mm)	No. 4 (4.75 mm)	No. 8 (2.36 mm)	No. 16 (1.18 mm)	No. 30 (600 µm)	No. 50 (300 µm)	No. 100 (50 µm)	No. 200 (75 µm)
A	Min. 100	95-100	80-100	50-85	25-60	5-30	Max. 10	
B	Min. 100	94-100					Max. 10	
C	Min. 100	94-100				Max. 25		

TABLE II-2
Soundness

Use	Soundness Loss Max. %	
	Magnesium Sulphate (5 Cycles)	Freeze and Thaw (20 Cycles)
Hydraulic Cement Concrete	18	8
Asphalt concrete surfaces and surface treatments	25	15
Asphalt concrete bases	30	15

- c) **Organic Impurities:** When fine aggregate is to be used in hydraulic cement concrete, the percentage of organic impurities shall conform to the requirements of AASHTO T21; however, material producing a darker color than that specified in AASHTO T21 may be accepted in accordance with the requirements of AASHTO M6.

- (d) **Void Content:** Void content will be tested in accordance with the requirements of VTM-5.
- (e) **Deleterious Material:** The amount of deleterious material in sands shall be not more than the following:

Material	% by Mass	AASHTO Test Method
Clay lumps	0.25	T112
Shale, mica, coated grains, soft or flaky particles	1.0	T113
Organic material	0	T21
Total material passing 75 µm sieve by washing ¹		T11 and T27
For use in concrete subject to abrasion	3	
For other concrete	5	

¹In the case of stone sand, if the material passing the 75 µm sieve is dust of fracture, essentially free from clay or shale, the percentages shown for use in concrete subject to abrasion and in other concrete may be increased to 5.0% and 7.0%, respectively.

SECTION 203--COARSE AGGREGATE

203.01--Description.

These specifications cover material for use as coarse aggregate in hydraulic cement concrete, asphalt concrete, asphalt surface treatments, and drainage.

203.02--Materials.

Coarse aggregate shall consist of crushed stone, crushed slag, or crushed or uncrushed gravel with clean, hard, tough, and durable pieces free from adherent coatings and deleterious amounts of friable, thin, elongated, or laminated pieces; soluble salts; or organic materials.

- (a) **Crushed hydraulic cement concrete** will be permitted for use as a coarse aggregate provided it conforms to the physical requirements specified herein and shows no adverse chemical reaction. Crushed hydraulic cement concrete will not be permitted in the following: (1) reinforced cement concrete (2) in combination with other materials in contact with geotextile fabric when such fabric is used as a drainage item and (3) in backfill or bedding for perforated pipe.
- (b) **Crushed gravel** shall consist of particles of which at least 80 percent by weight shall have at least one face fractured by artificial crushing. Tests will be performed in accordance with the requirements of VTM-15.
- (c) **Blast furnace slag** shall be relatively free from foreign minerals and glassy or spongy pieces. It shall have a dry rodded unit mass of at least 70 pounds per cubic yard for size No. 68 and smaller, and at least 65 pounds per cubic yard for larger sizes. Tests will be performed in accordance with the requirements of AASHTO T19. When used in asphalt surface treatments, blast furnace slag shall not contain more than 10 percent nonporous

material and shall have an absorption of at least 3 percent. Tests will be performed in accordance with the requirements of AASHTO T85.

203.03--Detail Requirements.

- (a) **Grading:** Open graded aggregates shall conform to the requirements of Table II-3. Tests will be performed in accordance with the requirements of AASHTO T27.
- (b) **Soundness:** Soundness shall conform to the requirements of Table II-4. Tests will be performed in accordance with the requirements of AASHTO T103 or T104.

**TABLE II-3
Sizes of Open Graded Course Aggregates**

Va. Size No.	Amounts Finer Than Each Laboratory Sieve (Square Openings) (% by Weight)															
	4 in.	3 1/2 in.	3 in.	2-1/2 in.	2 in.	1-1/2 in.	1 in.	3/4 in.	1/2 in.	3/8 in.	No. 4	No. 8	No. 16	No. 50	No. 100	
1	Min. 100	90-100		25-60		Max. 15		Max.5								
2			Min. 100	90-100	35-70	Max.15		Max. 5								
3				Min. 100	90-100	30-70	0-15		Max. 5							
357				Min. 100	95-100		35-70		10-30		Max. 5					
5						Min. 100	90-100	20-55	Max. 10	Max. 5						
56						Min. 100	90-100	40-85	10-40	Max. 15	Max. 5					
57						Min. 100	95-100		25-60		Max.10	Max.5				
67							Min.100	90-100		20-55	Max.10	Max.5				
68							Min. 100	90-100		30-65	5-25	Max. 10	Max. 5			
7								Min. 100	90-100	40-70	Max. 15	Max. 5				
78								Min. 100	90-100	40-75	5-25	Max. 10	Max. 5			
8									Min. 100	85-100	10-30	Max. 10	Max. 5			
8P									Min. 100	75-100	5-30	Max. 5				
9										Min. 100	85-100	10-40	Max. 10	Max. 5		
10										Min. 100	85-100				10-30	

**TABLE II-4
Soundness**

Max. Soundness Loss (%)		
Use	Magnesium Sulphate (5 Cycles)	Freeze and Thaw (20 Cycles)
Hydraulic cement concrete	12	5
Asphalt surface courses	15	6
Asphalt and aggregate bases	20	7
Select material (Type I) and subbase	30	12

- (c) **Abrasion Loss:** Abrasion loss shall conform to the requirements of Table II-5. Tests will be performed in accordance with the requirements of AASHTO T96 on aggregate with a grading the most nearly identical with the grading to be used in the work.

**TABLE II-5
Abrasion**

Max. Soundness Loss (%)		
Use	100 Rev.	500 Rev.
Grade A stone	9	40
Grade B stone	12	45
Grade C stone	14	50
Slag	12	45
Gravel	12	45

- (d) **Deleterious Material:** The amount of deleterious material shall be not more than the following:

Material	% by Weight	AASHTO Test Method
Coal and lignite	0.25	T113
Clay lumps	0.25	T112
Material passing No. 200 sieve by washing ¹	1.00	T11

¹When the material passing the No. 200 sieve by washing is dust of fracture, the percentage of deleterious material may be increased to 1.50%.

SECTION 206--LIGHTWEIGHT AGGREGATE

206.01--Description.

These specifications cover lightweight aggregate used in hydraulic cement concrete and asphalt surface treatment.

206.02--Detail Requirements.

Lightweight aggregate shall consist of clay, shale, or slate expanded through a sintering or rotary kiln.

- (a) **Lightweight aggregate used in hydraulic cement concrete** shall conform to the requirements of AASHTO M195.
- (b) **Lightweight aggregate used for asphalt surface treatment** shall conform to the requirements of AASHTO M195 except that Sections 3, 6, and 8 will not apply. Grading shall conform to the requirements of Table II-3 except that the maximum percentage by weight of material passing the No. 8 sieve shall be 16 percent and passing the No. 16 sieve shall be 9 percent.

SECTION 210--ASPHALT MATERIALS

SECTION 210—ASPHALT MATERIALS

210.01—Description

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

210.02—Materials

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

- (a) Rapid curing and medium curing liquid asphalts used as surface treatments shall contain a heat-stable additive conforming to the requirements of Section 211.
- (b) Liquid asphalt material will be tested for coating ability in accordance with the requirements of AASHTO T182, with the following modifications:
 - 1. Material that can coat 95 percent of a shady dolomite will be classified Type I.
 - 2. Material that can coat 95 percent of a siliceous gravel wetted with 2 percent water by weight will be classified Type II.
- (c) Rapid curing cutback asphalts shall conform to the requirements of AASHTO M81.
- (d) Medium curing cutback asphalts shall conform to the requirements of AASHTO M82.
- (e) Cements shall be viscosity graded and shall conform 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.
- (f) Emulsions shall conform to the requirements of AASHTO M208 and shall be Type I as specified herein except that CRS-2 shall be Type II as specified herein. CRS-1h shall conform to the requirements of AASHTO M208 for CRS-1 except that the penetration shall be 40 to 110. Emulsions will be sampled and tested in accordance with the requirements of AASHTO T59 except that viscosity will be tested in accordance with the requirements of VTM-64.

210.03—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 the Engineer. 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.

210.04—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.

SECTION 211—ASPHALT CONCRETE

211.01—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 Engineer, 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 Size ¹
SM-9.0 A	0 to 3	64-22	3/8 in
SM-9.0 D	3 to 10	70-22	3/8 in
SM-9.0 E	Above 10	76-22	3/8 in
SM-9.5 A	0 to 3	64-22	3/8 in
SM-9.5 D	3 to 10	70-22	3/8 in
SM-9.5 E	Above 10	76-22	3/8 in
SM-12.5 A	0 to 3	64-22	1/2 in
SM-12.5 D	3 to 10	70-22	1/2 in
SM-12.5 E	Above 10	76-22	1/2 in
IM-19.0 A	Less than 10	64-22	3/4 in
IM-19.0 D	10 and above	70-22	3/4 in
BM-25.0A	All ranges	64-22	1 in
BM-25.0D	Above 10	70-22	1 in

¹Nominal maximum size is defined as one sieve size larger than the first sieve to retain more than 10% aggregate.

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

211.02—Materials

- Asphalt materials shall conform to the requirements of Section 210 except asphalt cement materials shall be performance graded (PG) in accordance with the requirements of AASHTO M320. In addition, asphalt mixtures with the E designation shall meet the asphalt cement requirements in Section 211.04(e)1.
- Coarse aggregate shall be Grade A or B, conforming to the requirements, except for grading, of Section 203 for quality. In addition, the coarse aggregate sizes retained on and above the No. 4 sieve shall comply with the coarse aggregate requirements in Table II-12A. Flat and elongated (F&E) particles shall be tested in accordance with the requirements of ASTM D 4791, and coarse aggregate angularity (CAA) shall be tested on crushed gravel only in accordance with the requirements of ASTM D 5821.

- (c) Fine aggregate shall conform to the requirements except for grading of Section 202 for quality and the fine aggregate requirements in Table II-12A. Fine aggregate angularity (FAA) shall be tested in accordance with the requirements of AASHTO T 304 (Method A) and sand equivalent (SE) shall be tested in accordance with the requirements of AASHTO T 176.
- (d) After a gradation is performed:
1. If 10 percent or more of the material is retained on the No. 4 sieve, that portion will be tested in accordance with the requirements for coarse aggregate.
 2. If 10 percent or more of the material passes the No. 4 sieve, that portion will be tested for SE.
 3. If 10 percent or more of the material passes the No. 8 sieve, that portion will be tested for FAA.
- (e) Fine or coarse aggregates that tend to polish under traffic will not be permitted in any final surface exposed to traffic except in areas where the two-way average daily traffic is less than 750 vehicles per day and as permitted elsewhere in these Specifications.

**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	ASTM D4791 F & E”(5:1) Percent by Weight		
SM-9.0 A	85% min.	80% min.	10% Max ¹	40% min.	40% min.
SM-9.0 D	85% min.	80% min.	10% Max ¹	45% min.	45% min.
SM-9.0 E	95% min.	90% min.	10% Max*	45% min.	45% min.
SM-9.5 A	85% min.	80% min.	10% Max ¹	45% min.	45% min.
SM-9.5 D	85% min.	80% min.	10% Max ¹	45% min.	45% min.
SM-9.5 E	95% min.	90% min.	10% Max ¹	45% min.	45% min.
SM-12.5 A	85% min.	80% min.	10% Max ¹	45% min.	45% min.
SM-12.5 D	85% min.	80% min.	10% Max ¹	45% min.	45% min.
SM-12.5 E	95% min.	90% min.	10% Max ¹	45% min.	45% min.
IM-19.0 A	85% min.	80% min.	10% Max ¹	45% min.	45% min.
IM-19.0 D	95% min.	90% min.	10% Max ¹	45% min.	45% min.
BM-25.0 A	80% min.	75% min.	10% Max ¹	45% min.	45% min.
BM-25.0 D	80% min.	75% min.	10% Max ¹	45% min.	45% min.

¹ 10 percent measured at 5:1 on maximum to minimum dimension.

- (f) Mineral filler shall conform to the requirements of Section 201.
- (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 Engineer 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 or an approved chemical additive from the Department's approved list found in the Materials Division's Manual of Instructions, or a combination of both.

The mixture shall produce a tensile strength ratio (TSR) not less than 0.80 for the design and production tests. The TSR shall be determined in accordance with AASHTO T283, including a freeze-thaw cycle (4-inch specimens compacted with a Marshall hammer or 3.5 by 6-inch specimens when compacted with a gyratory compactor), except that the 16-hour curing time requirement and the 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 and shall be conducted in a laboratory approved by the Department.

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 that 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 Engineer 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 Engineer may require smaller sized particles to be introduced into the mix if the reclaimed particles are not broken down or uniformly distributed throughout the mixture during heating and mixing.

211.03—Job-Mix Formula

The Contractor shall submit for the Engineer'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 in accordance with 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 comply with the requirements of the job-mix formula for grading, asphalt content, temperature, and SUPERPAVE compaction results and the requirements of Section 315.

- (a) SUPERPAVE mixes shall be designed and controlled in accordance with the requirements of AASHTO R35 and as specified herein. The Contractor shall have available all of the equipment outlined in AASHTO T312 (section 4-6) and a Department-certified Asphalt Mix Design Technician. The SUPERPAVE mixture shall be compacted in a gyratory compactor with an internal angle of $1.16 + 0.02$ degrees. The internal angle shall be measured and calibrated using a cold (non-mix) device. The SUPERPAVE Gyratory Compactor (SGC) shall be one from the Department's approved list found in the Materials Division's Manual of Instructions. The SUPERPAVE mixes shall conform to the requirements of Table II-13 and Table II-14. Section 7.1.2 of AASHTO R30 shall be modified such that the compaction temperature is as specified in (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 two 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 in accordance with VTM-102 prepared by an approved testing laboratory, and viscosity data or supplier temperature recommendations for the asphalt cement if different from (d) 6 herein.
- (c) Three trial blends for gradation shall be run at one asphalt content. An aggregate blend that was previously developed and approved as a job-mix formula at a higher gyration level may be used for a subsequent year's mix designs that require a lower gyration level in lieu of developing three new trial blends.

**TABLE II - 13
ASPHALT CONCRETE MIXTURES: DESIGN RANGE¹**

Mix Type	Percentage by Weight Passing Square Mesh Sieves										
	2 in	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
SM-9.0 A,D,E					100 ²	90-100	90 max	47-67			2-10
SM-9.5 A,D,E					100 ²	90-100	80 max	38-67			2-10
SM-12.5 A,D,E				100	95-100	90 max	--	34-50			2-10
IM-19.0 A,D			100	90-100	90 max	--	--	28-49			2-8
BM-25.0 A, D		100	90-100	90 max	--	--	--	19-38			1-7
C (Curb Mix)					100	92-100	70-75	50-60	28-36	15-20	7-9

¹SM = Surface mix; IM = Intermediate Mix; BM = Base Mix; C = Curb Mix

² A production tolerance of 1% may be applied to this sieve, regardless of the number of tests in the lot.

**TABLE II-14
Mix Design Criteria**

Mix Type	VTM (%) Production (Note 1)	VFA (%) Design	VFA (%) Production (Note 2)	Min. VMA (%)	Fines/A (Note 3)	Number of Gyration			Density (%) at N Initial
						N Design	N Initial	N Max	
SM-9.0 A ^{Notes 1,2,3}	2.0-5.0	75-80	70-85	16	0.6-1.3	65	7	100	≤ 90.5
SM-9.0 D ^{Notes 1,2,3}	2.0-5.0	75-80	70-85	16	0.6-1.3	65	7	100	≤ 89.0
SM-9.0 E ^{Notes 1,2,3}	2.0-5.0	75-80	70-85	16	0.6-1.3	65	7	100	≤ 89.0
SM-9.5 A ^{Notes 1,2,3}	2.0-5.0	73-79	68-84	15	0.6-1.2	65	7	100	≤ 90.5
SM-9.5 D ^{Notes 1,2,3}	2.0-5.0	73-79	68-84	15	0.6-1.2	65	7	100	≤ 89.0
SM-9.5 E ^{Notes 1,2,3}	2.0-5.0	73-79	68-84	15	0.6-1.2	65	7	100	≤ 89.0
SM-12.5 A ^{Notes 1,2,3}	2.0-5.0	70-78	65-83	14	0.6-1.2	65	7	100	≤ 90.5
SM-12.5 D ^{Notes 1,2,3}	2.0-5.0	70-78	65-83	14	0.6-1.2	65	7	100	≤ 89.0
SM-12.5 E ^{Notes 1,2,3}	2.0-5.0	70-78	65-83	14	0.6-1.2	65	7	100	≤ 89.0
IM-19.0 A ^{Notes 1,2,3}	2.0-5.0	69-76	64-81	13	0.6-1.2	65	7	100	≤ 90.5
IM-19.0 D ^{Notes 1,2,3}	2.0-5.0	69-76	64-81	13	0.6-1.2	65	7	100	≤ 89.0
BM-25.0 ^{Notes 2,3,4}	2.0-5.0	67-75	62-83	12	0.6-1.3	65	7	100	≤ 89.0
BM-25.0 A,D ^{Notes 2,3,4}	2.0-5.0	67-75	62-83	12	0.6-1.3	65	7	100	≤ 89.0

¹SM = Surface mix; IM = Intermediate Mix; BM = Base Mix

Note 1: Asphalt content should be selected at 4.0 percent 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 3.5 % air voids. BM-25.0 A shall have a minimum asphalt content of 4.4% unless otherwise approved by the Engineer. BM-25.0 D shall have a minimum asphalt content of 4.6%, unless otherwise approved by the Engineer.

- d) The SUPERPAVE design test data shall include, but not be limited to, the following information:
1. Grading data for each aggregate component of three trial blends shall be submitted to the Department. The data for the mixture will show percent passing for the following sieves: 2 inch, 1 1/2 inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, 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 the 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 Section 211.02 (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 tests conducted in accordance with 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 (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 specified in (d) 1. herein shall be reported, beginning with the top size for the mix.
 4. The following volumetric properties of the compacted mixture, calculated on the basis of the mixture's maximum specific gravity determined in accordance with AASHTO T-209 shall be reported to the Engineer. The mixture shall be aged in accordance with AASHTO R30 and the bulk specific gravity of the specimens determined in accordance with AASHTO T-166, Method A, for each asphalt content tested. Properties shall be determined and reported in accordance with the requirements of AASHTO R35..
 - 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 (c) 4. herein shall be reported to three decimal places.
 6. The mixing and compaction temperature for testing shall be as follows:
 - a. For mix designation A , the mix temperature shall be 300 degrees F to 310 degrees F and the compaction temperature shall be 285 degrees F to 290 degrees F.
 - b. For mix designation D, the mix temperature shall be 310 degrees F to 320 degrees F and the compaction temperature shall be 295 degrees F to 300 degrees F.

- c. In cases involving PG 76-22 or modified binders, the temperatures shall be based on documented supplier's recommendations.
- 7. The field correction factor as determined by subtracting the bulk specific gravity of the aggregate from the effective specific gravity of the aggregate at the design asphalt content.
- 8. Permeability test data shall be submitted in accordance with VTM-120 using either single point verification or the regression method for each surface mix having a different gradation. If the average of the permeability results from the single point verification method exceeds 150×10^{-5} cm/sec, or if the regression method predicts a permeability exceeding 150×10^{-5} cm/sec at 7.5% voids, the Contractor shall redesign the mixture to produce a permeability number less than 150×10^{-5} cm/sec.
- (e) The SUPERPAVE design binder content test data shall be plotted on graphs as described in AASHTO R 35 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 Department. The Department and Contractor will test the mixture using samples removed from production. The following tests will be conducted to determine the properties listed:

Property	Test
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 Engineer 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 Department determines that the mixture being produced does not conform to the approved job-mix formula and volumetric properties specified in Table II-14 based on the Department's 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 that 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 Department project work. No further paving for the Department using that specific mixture shall 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 R35:

TABLE II-14A
Recommended Performance Grade of Asphalt

Mix Type	Percentage RAP in Mix	
	0.0 - 20.0	Over 20.0
SM-9.0A, SM-9.5A, SM-12.5A	PG 64-22	PG 58-28
SM-9.0D, SM-9.5D, SM-12.5D	PG 70-22	PG 64-28
SM-9.0E, SM-9.5E, SM-12.5E	PG 76-22	PG 70-28
IM-19.0A	PG 64-22	PG 58-28
IM-19.0D	PG 70-22	PG 64-28
BM-25.0 A	PG 64-22	PG 64-22 ¹
BM-25.0D	PG 70-22	PG 70-22 ¹

¹BM-25.0A mixes using more than 25 % RAP shall use a PG 58-22 and BM-25.0D mixes using more than 25% RAP shall use a PG 64-22.

Based on rut testing performed by the Department and/or field performance of the job-mix, the Engineer reserves the right to require adjustments to the job-mix formula.

211.04 - - 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, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings 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. At the discretion of the Engineer, a SM-9.5AL or SM-12.5AL may be specified and polish susceptible aggregates may be used (without percentage limits).

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

NOTE: At the discretion of the Engineer, 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 and no more than 20 percent of the total aggregate may be polish susceptible.

- (c) **Types BM-25.0A and BM-25.0D asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or 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 Department's approved list; combined with 6.0 to 9.0 percent of PG 64-22. This mix does not require a volumetric mix design or volumetric testing under the SUPERPAVE system.

- (e) **Type SM-9.5, SM-12.5, IM-19.0, and BM-25.0 asphalt concrete** 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) 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. Modified mixtures shall be designated with a (M) following the standard mix designation. Type (M) 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 Department's approved list found in the Materials Division's Manual of instructions. These mixes shall be designated with an (S) following the standard mix designation. The minimum required additive shall be as specified on the approved list found in the Materials Division's Manual of instructions.

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

The Contractor shall have a VDOT certified Asphalt Mix Design Technician for designing and adjusting mixes as necessary. The Asphalt Mix Design Technician or Asphalt Plant Technician may perform testing of asphalt mixes. The Asphalt Mix Design Technician shall be responsible for reviewing and approving the results of all testing. The Asphalt Mix Design Technician shall be available and have direct communication with the plant for making necessary adjustments in the asphalt concrete mixes at the mixing plant. The Asphalt Mix Design Technician and Asphalt Plant Technician shall each be capable of conducting any tests necessary to put the plant into operation, however, it shall be the responsibility of the Asphalt Mix Design Technician to produce a mixture within the requirements of these specifications. The Department will award Certification. The Department will conduct onsite inspections so the Contractor's Asphalt Mix Design Technician can demonstrate knowledge of SUPERPAVE mix design and production requirements on Department supplied mixture.

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 Engineer.

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 AASHTO R30 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. The Department will conduct onsite inspections so the Contractor's Asphalt Mix Design Technician can demonstrate knowledge of SUPERPAVE mix design and production requirements on Department supplied mixture.

Aggregate specific gravity and aggregate property tests shall be conducted by a VDOT certified Aggregate Properties Technician or Asphalt Mix Design Technician on each aggregate component (including RAP) or total aggregate mixture once at design and once prior to beginning production in each calendar year. Sand Equivalent shall not be performed on RAP. In addition, for each 50,000 tons of each aggregate size used at each plant, aggregate specific gravity and aggregate property tests shall be reported on each aggregate component or the total aggregate mixture. Otherwise, if the total blend (cold feed) is used to obtain aggregate specific gravity and aggregate properties, these tests shall be run for each 50,000 tons of the total blend.

Field Superpave tests shall be performed to N_{design} gyrations as specified in Table II-14. At the Engineer's discretion, the N_{max} requirement may be verified.

211.06 -- Tests

The Department may sample materials entering into the composition of the asphalt concrete, the mixture or the completed pavement. The Contractor shall cooperate with the Engineer 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:

Mix Type	Recovered Penetration	Ductility at 77°F
SM-9.0A, 9.5A, 12.5A	Min 35	Min 40 cm
SM-9.0D, 9.5D, 12.5D	Min 25	Min 40 cm
IM-19.0A	Min 35	Min 40 cm
IM-19.0D	Min 25	Min 40 cm
BM-25.0A	Min 35	Min 40 cm
BM-25.0D	Min 25	Min 40 cm

NOTE: Penetration and Ductility tests on the recovered asphalt cement 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 M320. If the samples meet the required grade specified in Section 211.01, they will be deemed acceptable.

When the Department performs PG grading on a Contractor's liquid asphalt storage tank, the Engineer 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. The asphalt concrete producer and binder supplier shall determine corrective action with the approval of the Engineer.

211.07 --- Plant Inspection

The preparation of asphalt concrete mixtures will be accepted under a quality assurance plan. The Contractor shall provide a laboratory as specified in Section 106.07.

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.

211.08 -- Acceptance

Acceptance shall be made under the Department's quality assurance program which includes the testing of production samples by the Contractor and monitor samples by the Department. Sampling and testing for the determination of grading, asphalt cement content and temperature shall be performed by the Contractor, and the Department will perform independent monitor checks at a laboratory of its discretion. The Contractor shall provide copies of such test results to the Department on forms furnished by the Department. Where 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 106.06, 200.02 and 200.03, and 315 or relieving the Contractor of the obligation to furnish and install a finished functional product which conforms to the requirements of the Contract. In the event a statistical comparative analysis of the Contractor's test results and the Department's monitor tests indicate a statistically significant difference in

the results and either of the results indicate that the material does not conform to the grading and asphalt cement content requirements of the Specifications, an investigation will be made to determine the reason for the difference. In the event it is determined from the investigation that the material does not conform to the requirements of the Contract, price adjustments will be made in accordance with the requirements of Section 211.09 of the Specifications.

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 2000 ton lot (4000 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 truck loads 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 Department 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 Engineer. 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.

Field SUPERPAVE tests will be performed by the Department in accordance with the requirements of AASHTO R35 during the production of the approved job-mixes designed by the SUPERPAVE method. Aging, as described in AASHTO R30, shall not be performed. Should any field SUPERPAVE test fail with regard to the limits specified in Table II-14, the Department may require that production be stopped until necessary corrective action is taken by the Contractor. The Engineer will investigate and determine the acceptability of material placed and represented by failing field SUPERPAVE test results.

Should visual examination by the Engineer 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.

**TABLE II-15
Process Tolerance**

Tolerance on Each Laboratory Sieve and Asphalt Content - Percent Plus and Minus												
Number	Top											
Tests	Size ¹	1 ½ in	1 in	¾ in	½ in	⅜ 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

¹ Defined as the sieve that has 100% passing as defined in Table II-13

211.09 – Adjustment system

In the event a lot of material does not conform to the acceptance requirements of Section 211.08, adjustment points will be determined as follows:

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

Sieve Size	(APPLIED IN 0.1% INCREMENTS)
1 1/2 in	1
1 in	1
3/4 in	1
1/2 in	1
3/8 in	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(s). 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-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 & A. C.	3 Adjustment Point For Each Sieve Size & A.C.
1/2 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

A separate standard deviation will be determined by the Department for each calendar year's production of each mix type produced by a plant.

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

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

211.10 -- 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 Department lab perform tests on five additional samples taken from randomly selected locations in the roadway where the lot was placed. In the event the Engineer determines that one of the four tests results appears to be questionable, the Department 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, i.e, 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 Department lab perform additional testing of that lot. In the event the Engineer determines that the mean of the four original test results are questionable, the Department 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 Department lab test the material in accordance with Department approved procedures. The Engineer 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 211.09.

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

Application Rate	Minimum Sample Size
125 lbs/yd ²	8 by 8 inches
150 lbs/yd ²	7 by 7 inches
200 lbs/yd ²	6 by 6 inches
300 lbs/yd ²	5 by 5 inches

211.11 Handling and Storage of 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.

211.12 -- 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:** A certified Asphalt Plant Technician shall sample material at the plant.
- (b) **Plant Scales:** Scales shall be approved in accordance with the requirements of Section 109.01.
- (c) **Drier:** The plant shall include a drier(s) that 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 that 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.

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:** Pollution control shall conform to the requirements of Section 107.14.
- (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. 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 at $\pm 20^{\circ}$ F during operation of the plant by means of an automatic temperature control device. A sampling valve shall be provided for sampling of each asphalt storage tank. If there are multiple storage tanks, then a dedicated valve for each tank shall be provided.
- (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 Engineer. 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 (j) herein.

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 Engineer. Written permission of the Engineer 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 (j) herein.

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.

Interlock cutoff circuits shall be included 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:** These shall conform to the requirements of Section 109.01.

211.13 - 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 Engineer 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 Engineer to accomplish the degree of aggregate distribution necessary to obtain complete and uniform coating of the aggregate with asphalt.

211.14 -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 Engineer in the event there is an excessive amount of heat loss, segregation or oxidation of the mix.

211.15 -Initial Production

At the start of production of a mix not previously used on a state roadway, the Contractor shall place 100 to 300 tons or up to one day's production as directed by the Engineer at and at an approved site which may be project site, so the Engineer can examine the process control of the mixing plant, the Contractor's placement procedures, surface appearance, and the mix compaction patterns of the Contractor's roller(s) 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 Engineer 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.

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
STONE MATRIX ASPHALT (SMA)

July 1, 2006

I. DESCRIPTION

This work shall consist of furnishing a Stone Matrix Asphalt (SMA) bituminous mixture in accordance with Sections 211 and 315 of the Specifications and this Special Provision.

II. MATERIALS

(a) **Coarse Aggregate:** Coarse aggregate shall conform to the following requirements:

1. Los Angeles Abrasion	AASHTO T96	40% max.
2. Flat and Elongated Particles		
Measured on No. 4 retained, max. to min.	VTM-121	
3 to 1		20% max.
5 to 1		5% max.
3. Magnesium Sulphate Soundness Loss 5 cycles	AASHTO T104	15% max.
4. Particles retained on the No. 4 sieve shall have at least	ASTM D5821	
one fractured face		100% min.
two fractured faces		90% min.
5. Absorption	AASHTO T 85	2% max.

Except for the determination of Flat and Elongated Particles (2), the aggregate properties specified are for each stockpile of coarse aggregate material designated on the job mix form (TL-127). The material contained in each stockpile shall meet the minimum or maximum criteria specified.

For Flat and Elongated Particles, these values are based on the mathematical blend of the coarse aggregate material designated on the job-mix form (TL-127). During production, these values are based on the SMA material sampled during the Acceptance process (QC testing).

Use of slag not permitted.

(b) **Fine Aggregate:** Fine aggregate shall consist of a blend of 100 percent crushed aggregate. The magnesium sulfate soundness loss in 5 cycles shall not exceed 20 percent. In addition, the liquid limit shall not exceed 25 as determined by AASHTO T89.

(c) **Asphalt Binder:** Asphalt binders shall be Performance Graded Binder PG 70-22 or Polymer modified PG 76-22 conforming to the requirements of mix designation (M), as designated by the Department. The supplier shall certify to the Department that the binder meets all the properties of that grade as shown in AASHTO M320 (Provisional Specification MP-1) for Performance Graded Asphalt Binder. This certification shall be based on testing performed on samples of binder provided to the Contractor for incorporation into the mixture. Certification based on testing performed on laboratory produced binders will not be acceptable.

The Contractor shall submit to the Engineer for Department review the source, formulation, and PG grading of the binder at least 15 days prior to the production of the SMA mixture.

During mixture production, testing to determine the binder PG grade will be performed by the Department on samples taken from storage at the hot mix asphalt plant as directed by the Engineer.

- (d) **Mineral Filler:** Mineral filler shall consist of finely divided mineral matter such as rock or limestone dust, fly ash, or other suitable material. Hydrated lime will not be allowed. Up to two mineral fillers may be blended to meet the mineral filler requirements. Mineral filler shall meet the requirements of Section 201 with the following modifications. The Mineral Filler or Mineral Filler blend used in surface and intermediate SMA shall have a minimum of 55% passing the No. 200 sieve. At the time of use, it shall be sufficiently dry to flow freely and be essentially free from agglomerations.
- (e) **Fiber Additive:** Cellulose or mineral fiber in either loose or pelletized form shall be used. The minimum dosage rates for cellulose is 0.3 percent by weight of total mixture, and for mineral fiber is 0.4 percent by weight of total mixture. During production, the Department may require the fiber additive be increased if visual inspection or draindown testing on plant produced material indicates that draindown in excess of 0.3 percent by weight of the mix is occurring as determined by the VTM-100. Allowable tolerances of fiber dosage shall be \pm 10 percent of the required fiber weight.

Fibers will be accepted based on the manufacturer's certification.

CELLULOSE FIBER PROPERTIES

Sieve Analysis

Method A

Alpine Sieve¹ Analysis:

Fiber Length:	0.25 inch	(maximum)
Passing No. 100 Sieve	70%	(\pm 10%)

Method B

Mesh Screen² Analysis:

Fiber Length:	0.25 inch	(maximum)
Passing No. 20 Sieve	85%	(\pm 10%)
No. 40 Sieve	65%	(\pm 10%)
No. 140 Sieve	30%	(\pm 10%)

Ash Content³ 18% (\pm 5%) non-volatile

pH⁴ 7.5 (\pm 1.0)

Oil Absorption⁵ 5.0 (\pm 1.0)
(times fiber weight)

Moisture Content⁶ < 5%

¹Method A: Alpine Sieve Analysis. This test is performed using an Alpine Air Jet Sieve (Type 200 LS). A representative five-gram sample of fiber is sieved for 14 minutes at a controlled vacuum of 22 inches (\pm 3 inches) of water. The portion remaining on the screen is weighed.

²Method B: Mesh Screen Analysis. This test is performed using standard Nos. 20, 40, 60, 80, 100, and 140 sieves, nylon brushes and a shaker. A representative 10-gram sample of fiber is sieved, using a shaker and two nylon brushes on each screen. The amount retained on each sieve is weighed and the percentage passing calculated.

³Ash Content: A representative 2-3 gram sample of fiber is placed in a tared crucible and heated between 1100 °F and 1200°F for not less than two hours. The crucible and ash are cooled in a desiccator and reweighed.

⁴pH Test: Five grams of fiber is added to 3.5 oz. (100 ml) of distilled water, stirred and let set for 30 minutes. The pH is determined with a probe calibrated with pH 7.0 buffer.

⁵Oil Absorption Test: Five grams of fiber is accurately weighed and suspended in an excess of mineral spirits for not less than five minutes to ensure total saturation. It is then placed in a screen mesh strainer (approximately 0.5 square millimeter hole size) and shaken on a wrist action shaker for ten minutes (approximately 1 ¼ inch motion at 20 shakes/minute). The shaken mass is then transferred without touching, to a tared container and weighed. Results are reported as the amount (number or times its own weight) the fibers are able to absorb.

⁶Moisture Content: Ten grams of fiber is weighed and placed in a 250° F forced air oven for two hours. The sample is then reweighed immediately upon removal from the oven.

MINERAL FIBER PROPERTIES

Size Analysis:

Fiber Length ¹	0.4 inch	(maximum)
Thickness ²	0.0002 inch	(average)
Shot Content ³		
No. 60 Sieve	90% passing	(minimum)
No. 230 Sieve	70% passing	(minimum)

¹The fiber length is determined according to the Bauer McNett fractionation.

²The fiber diameter is determined by measuring at least 200 fibers in a phase contrast microscope.

³Shot content is a measure of non-fibrous material. The shot content is determined on vibrating sieves. Two sieves, No. 60 and No. 230, are typically used, for additional information see ASTM C612.

NOTE: When using pelletized fiber, the dosage rate shall be adjusted to meet the specified minimum dosage rates for cellulose and mineral fiber. Pelletized fiber consists of either cellulose or mineral fiber and a binder. The specified minimum dosage rates are based on fiber content only. Therefore, the amount of pelletized fiber added shall typically be higher than loose fiber.

(f) **RAP:** Use of RAP will not be permitted.

III. COMPOSITION OF SMA MIXTURE

The SMA mixture shall be designed and tested using a gyratory compactor and shall conform to the requirements listed in Table A and Table B. One percent hydrated lime will be required as an antistripping additive. An alternative antistripping additive can only be used if permitted by the Engineer.

TABLE A - SMA DESIGN RANGE

Type#	Percentage by Weight Passing Square Mesh Sieves (in)							
	1	3/4	1/2	3/8	No. 4	No. 8	No. 30	No. 200
Surface Mixes								
SMA 12.5	-	100	85-95	80 max	22-30	16-24	12-16	8-12
SMA 9.5	----	100	90-100	70-85	25-40	15-25	-	10-12
Intermediate Mixes								
SMA 19.0	100	85-95	50-60	30-45	----	16-24	12-16	8-10

Note- The required PG Binder will be shown in parenthesis as part of the mix type on the plans or proposal e.g. SMA 12.5 (76-22)

TABLE B - SMA MIXTURE REQUIREMENTS

Mix Type	VTM *	VMA	VMA	VCA	AC	Draindown	Gyrations	Specimen
		Design	Production	Design and Production				
	%	Min %	Min %	%	Min %	%		Height****
SMA 9.5	2.0-4.0	18.0	17.0	<VCA _{DRC}	6.3	0.3 max	75	115
SMA 12.5	2.0-4.0	18.0	17.0	<VCA _{DRC}	6.3	0.3 max	75	115
SMA19.0	2.0-4.0	17.0	16.0	<VCA _{DRC}	5.5	0.3 max	75	115

*Asphalt content shall be selected at the midpoint of the VTM range but shall not be less than the minimum specified.

Fines-Effective Asphalt Ratio shall be 1.2-2.0.

The Voids in Coarse Aggregates (VCA) of the Dry Rodded Condition (DRC) and mix shall be determined in accordance with VTM-99.

**** Specimen height after compaction shall be between 4.25 inches to 4.75 inches(110 to 120 millimeters).

NOTE: The SUPERPAVE Gyratory Compactor (SGC) shall be from the approved list maintained by the Materials Division. Gyratory procedures shall be performed in accordance with VTM 99 Design of SMA Mixtures. Calculations for volumetrics shall be performed in accordance with VTM 57 and VTM 58, 6-inch (150mm) specimens.

Draindown testing shall be in accordance with VTM-100 Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures.

IV. ACCEPTANCE

A lot will be considered acceptable for gradation and asphalt content if the mean of the test results obtained is within the tolerance allowed from the job-mix formula. The production tolerances for the control sieves and asphalt content shall be as follows:

PROCESS TOLERANCE

Tolerance on each laboratory sieve (in) and Asphalt Content – Percent Plus and Minus

No. Tests	Top Size	3/4	1/2	3/8	No. 4	No. 8	No. 30	No. 200	AC
1	0.0	8.0	8.0	8.0	6.0	6.0	6.0	4.0	0.60
2	0.0	5.7	5.7	5.7	4.3	4.3	4.3	2.8	0.43
3	0.0	4.4	4.4	4.4	3.3	3.3	3.3	2.2	0.33
4	0.0	4.0	4.0	4.0	3.0	3.0	3.0	2.0	0.30
8	0.0	2.8	2.8	2.8	2.1	2.1	2.1	1.4	0.21

The production tolerance for the specimen height after compaction is 4.25 to 4.75 inches (110 to 120 mm).

The Contractor shall check and report the Voids in Coarse Aggregates (VCA) of the mix during production for each gyratory sample. If the VCA of the mix exceeds the VCA of the Dry Rodded Condition (DRC), the Contractor shall stop production and notify the Engineer. Production shall not resume until the Contractor has made corrective action.

The Contractor shall check and report the percentage of Flat and Elongated Particles (F&E) in the Coarse Aggregates of the mix during production. When the SMA material is sampled for acceptance (gradation and AC content); one of the four sub-lots must be selected for F&E verification. The F&E testing will be performed on the coarse aggregate material retained on the #4 sieve (per ASTM VTM-121) after the gradation analysis is performed. At initial start-up of production, the F&E shall be determined for each of the first two lots of material produced. If passing results are obtained on each sample in the first two lots, then F&E testing shall be performed on a frequency of every second lot of material produced (i.e. – Lots 4, 6, 8, etc.). If the F&E of the mix exceeds the specified limits, the Contractor shall stop production and notify the Engineer. Production shall not resume until the Contractor has taken corrective action and the Engineer has approved the corrective action. Once production has resumed, the Contractor shall determine the F&E of the mix for two consecutive lots. If passing results are obtained for these two lots, then the F&E testing frequency shall return to every second lot of material produced.

In the event the Department determines that the mixture being produced does not conform to the approved job-mix formula and volumetric properties in Table B based on Department 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 300 tons maximum if such material is to be placed in Department project work. No further paving for the Department using that specific mixture shall occur until the acceptability of the mixture being produced has been verified using the 300 ton constraint.

V. SMA MIXING PLANT

Plants used for the preparation of the SMA mixture shall conform to the following:

(a) **Handling Mineral Filler:** Adequate dry storage shall be provided for the mineral filler, that will, at a minimum, consist of a waterproof cover that shall completely cover the stockpile at all times. Provisions shall be made for metering of the filler into the mixture uniformly and in the desired quantities. In a batch plant, mineral filler shall be added directly into the weigh hopper. In a drum plant, mineral filler shall be added directly onto the cold feed belt. Equipment shall be capable of accurately and uniformly metering the large amounts of mineral filler up to 25 percent of the total mix.

(b) **Fiber Addition:** Adequate dry storage shall be provided for the fiber additive, and provisions shall be made for accurately and uniformly metering fiber into the mixture at plus or minus 10 percent of the desired quantities.

Introduction of loose or pelletized fiber shall require a separate system that can accurately proportion, by weight, the required quantity of fiber in such a manner as to ensure consistent, uniform blending into the mixture at all rates of production and batch sizes. This supply system shall be interlocked with the other feeding devices of the plant system and sensing devices shall provide for interruption of mixture production if the introduction of fiber fails.

Batch Plant: Loose fiber or pelletized fiber shall be added through a separate inlet directly into the weigh hopper above the pugmill. The addition of fiber should be timed to occur during the hot aggregate charging of the hopper. Adequate dry mixing time is required to ensure proper blending of the aggregate and fiber stabilizer. Therefore, dry mixing time shall typically be increased 5 to 15 seconds. Wet mixing time shall typically be increased at least 5 seconds for cellulose fibers, and up to 5 seconds for mineral fibers, to ensure adequate blending with the asphalt cement.

When fiber is used, the fiber supply system shall include low level and no flow indicators and a printout of the date, time, and net batch weight of fiber.

Drum Mix Plant: When fiber is used, the fibers shall be added in such a manner as not to be entrained into the exhaust gases of the drum plant. The fiber supply system shall include low level and no flow indicators and a printout of status of feed rate in pounds/minute.

When pelletized fibers are used, they shall be added directly into the drum mixer through the RAP inlet or a specialized fiber inlet. Operation of the drum mixer shall be such as to ensure complete blending of the pelletized fiber into the mix.

(c) **Hot Mixture Storage:** When the hot mixture is not hauled immediately to the project and placed, suitable bins for storage shall be provided. Such bins shall be either surge bins to balance production capacity with hauling and placing capacity or storage bins, which are heated and insulated and which have a controlled atmosphere around the mixture. The holding times shall be within limitations imposed by the Engineer, based on laboratory tests of the stored mixture. In no case shall the SMA mixture be kept in storage more than 8 hours.

(d) **Mixing Temperatures:** Typical plant mixing temperature shall be 315⁰-340⁰F and at no time shall the mixing temperature exceed 350⁰ F.

VI. WEATHER RESTRICTIONS

Weather Restrictions: Placement of the SMA mixture shall be permitted only when the ambient and surface temperatures are 50° F or above.

VII. PLACING AND FINISHING

Placing and Finishing: The mixture temperature in the truck shall not be less than 300°F for mixtures containing PG 70-22 and 310°F for mixtures containing PG 76-22. The temperature immediately behind the screed shall not be less than 290° F for mixtures containing PG 70-22, and shall be not less than 300 ° F for mixtures containing PG 76-22.

A continuous paving operation that provides for constant steady movement of the paver shall be maintained. In the event that excessive stop and go of the paver is occurring, production and laydown of the mixture may be stopped until the Contractor has made satisfactory changes in the production, hauling, and placement operations resulting in a constant steady movement of the paver.

A Material Transfer Vehicle (MTV) shall be used during the placement of all SMA mixes. The paving operation shall have remixing ability either in the MTV or in a paver mounted hopper. The remixing capacity shall not be less than 15 tons. In the event that breakdown occurs, paving shall be discontinued and no more material shall be shipped from the hot mix plant.

VIII. COMPACTION

Compaction: Immediately after the mixture has been spread and struck off, it shall be thoroughly and uniformly compacted by rolling. Rolling shall be accomplished with steel wheel roller(s) with a minimum weight of 10 tons. A minimum of three rollers shall be available at all times for compaction and/or finish rolling.

To minimize coarse aggregate fracture/breakage in the aggregate skeleton of SMA mixes, the use of vibratory rollers on SMA should be approached with caution. If a vibratory roller is used, the mat should receive not more than 3 vibratory passers and these only at the highest possible frequency and lowest amplitude setting.

Rolling procedures shall be adjusted to provide the specified pavement density. Rollers shall move at a uniform speed not to exceed 3 mph with the drive wheel nearest the paver. Rolling shall be continued until all roller marks are eliminated and the minimum density has been obtained. The Contractor shall monitor density during the compaction process by use of nuclear density gauges to assure that the minimum required compaction is being obtained. During the trial section, the Department will randomly select three plugs or core locations to determine the in-place density in accordance with VTM -22.

To prevent adhesion of the mixture to the rollers, it shall be necessary to keep the wheels properly moistened with water possibly mixed with very small quantities of detergent or other approved material.

The Contractor shall perform acceptance testing for density for each day's production by obtaining one 4 x 4 inch sawed specimen or 4 inch diameter core at 5 stratified random locations specified by the Engineer. The 5 cores or plugs shall be obtained and the in place density determined in accordance with VTM-22. All core locations shall be numbered sequentially per roadway, marked on the pavement, and filled with compacted SMA mixture prior to completion of each day of production. The average density of the five cores as determined by VTM-22 shall be 94 to 98 percent for 100 percent pay. All cores or plugs shall be bulked in the presence of the Department. The Department reserves the right to have the cores or plugs bulked on the project site. The payment for density will be in accordance with the following:

PAYMENT SCHEDULE

Percent Density Achieved	Percent of Payment
More than 98.0	97
94.0 to 98.0	100
92.0 to 93.9	85
90.0 to 91.9	65
Less than 90.0	Remove and Replace

IX. TRIAL SECTION

Trial Section: Trial section(s), maximum 300 tons, shall be constructed at a site approved by the Engineer at least one week before, but no more than 30 days prior to, roadway construction to examine the mixing plant process control, mixture draindown characteristics, placement procedures, SMA surface appearance, compaction patterns and to calibrate the nuclear density device. In addition, the percentage of Flat and Elongated Particles will be calculated on the SMA material produced for the trial section per VTM-121 and compared to the maximum limits specified in the Coarse Aggregate Table in section II(a). A passing F&E sample is required for acceptance of the Trial Section.

X. PREPAVING CONFERENCE

Prepaving Conference: The Department prior to starting production will hold a prepaving conference. Those attending shall include the Contractor's production supervisor and laydown supervisor, a representative of the fiber supplier, and a representative of the asphalt binder supplier.

XI. MEASUREMENT AND PAYMENT

Stone matrix asphalt will be measured in tons and paid for at the contract unit price in tons, for the mix type specified, which price shall include all materials, additives, and equipment as described herein.

The initial trial section will be paid for at the contract unit price for the mix type specified. With the approval of the Engineer, up to 2 additional trial sections of the mix type specified will be paid for at the contract unit price. The Department will only pay for up to 3 trial sections at the contract unit price. If more than 3 trial sections are needed, the Department and Contractor shall negotiate the price based upon a reduced percentage of the contract unit price.

Payment will be as follows:

Pay Item	Pay Unit
Stone Matrix Asphalt, SMA-9.5 (70-22)	Tons
Stone Matrix Asphalt, SMA-9.5 (76-22)	Tons
Stone Matrix Asphalt, SMA-12.5 (70-22)	Tons
Stone Matrix Asphalt, SMA-12.5 (76-22)	Tons
Stone Matrix Asphalt, SMA-19.0 (70-22)	Tons
Stone Matrix Asphalt, SMA-19.0 (76-22)	Tons

Special Provision

(c211fg0-0708)

Section 211 - FOR SURFACE AND INTERMEDIATE MIXES USING RAP

SECTION 211 FOR SURFACE AND INTERMEDIATE MIXES USING RAP - Asphalt concrete mixtures used in surface and intermediate courses shall conform to the requirements of Section 211 of the Specifications except as specified herein for the following:

Section 211—Asphalt Concrete is amended as follows:

Section 211.01—Description is amended to replace the “ESALs” table in the second paragraph with the following

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

Section 211.03(f) is amended to replace the first sentence in the second paragraph with the following:

The Department will perform rut testing in accordance with the procedures detailed in VTM-110.

TABLE II-14A RECOMMENDED PERFORMANCE GRADE OF ASPHALT is replaced with the following:

TABLE II-14A
Recommended Performance Grade of Asphalt Cement

Mix Type	% RAP ≤ 20.0%	20% < % RAP ≤ 30%
'A' Designated Surface & Intermediate Mixes	64-22	64-22
'A' Designated Surface & Intermediate Mixes	PG 76-22	64-22

Section 211.06—Tests is amended to replace the “Absorption Recovery” table in the second paragraph with the following:

Mix Type	Recovered Penetration		Ductility at 77°F
	RAP % ≤ 20%	RAP % >	
SM-9.0A, 9.5A, 12.5A	Min 35	Min 35	Min 40 cm
SM-9.0D, 9.5D, 12.5D	Min 35	Min 35	Min 40 cm
IM-19.0A	Min 35	Min 35	Min 40 cm
IM-19.0D	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

Section 211.06—Testing is amended to replace the third paragraph with the following:

Absorption recovery samples shall be PG graded according to the requirements of AASHTO M 320-05. Samples meeting the required grades specified in Section 211.01 of the Specifications shall be acceptable.

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